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CHOREA

AND

WHOOPING-COUGH

CHOREA

AND

WHOOPING-COUGH

FIVE LECTURES

BY

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'No arrangement is so clear or practically so useful as one which connects the morbid actions with the natural and healthy functions of the same parts. The former grow gradually out of the latter; and though presenting in this morbid state many peculiar modifications, yet are there none which may not be referred, directly or indirectly, to some equivalent phenomenon of healthy action'—SIR H. HOLLAND, *Notes and Reflections* (second edition, 1840), p. 334

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OF the following Lectures, the four on Chorea were delivered at the Hospital for Sick Children in Great Ormond Street and formed part of a course which it is the custom for the medical officers to give in turn during each summer session. The Lecture on Whooping-cough was given at the Westminster Hospital in the ordinary routine of clinical teaching at a time when several examples of the affection happened to be in the wards. This account of their origin makes it unnecessary to add that the Lectures do not aim at giving a complete or systematic account of the diseases they discuss.

Christmas 1877.

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INTRODUCTION.

IT is part of the design of the following pages to place chorea and whooping-cough in the category of functional derangements. Whether or not this object is accomplished the Lectures themselves must be left to show. Yet, inasmuch as the word 'functional,' when applied to disease, is regarded by many as an evasive expression, useful only as a cloak for ignorance, I would say something here in anticipation of this preliminary objection, and endeavour to show that the term (whether applicable, or not, in the present case) is both necessary and expressive.

If the animal functions were performed always after one pattern, every deviation from which could be certainly recognised by a corresponding tissue-change, the definition of disease would be easy and precise. In the actual circumstances, however, the line which separates it from disordered function is

in great measure arbitrary. Variations in function, which are temporary and occasional, depend upon material causes no less than do the several phases of what we choose to call disease; and, if anyone should say that this latter term becomes appropriate so soon as the structure-change becomes appreciable by the senses, such a description implies that the point of division is continually shifting, as the means and opportunities of observation multiply. Thus functional disease signifies no more than the imperfection of our search for the material basis of bodily derangement; it occupies that interval, which it is the main object of pathology to abridge, between the earliest recognition of disorder in act, and the earliest discovery of the structural change on which it depends.

But while the term 'functional' implies a limited knowledge of disease, it is by no means to be admitted as the expression of mere ignorance. On the contrary, it indicates the nature of the morbid phenomena to which it is applied in the fittest terms at the time available. It is to be considered that the aberrations from normal life which constitute disease are no more susceptible

of complete explanation than are the processes which they disturb or interrupt. The most that can be done in either case is to refer the particular phenomenon to its class, so as to indicate its origin and connections. A fit of hysteria is as well accounted for by reference to the laws of emotion as is a fit of convulsion by the discovery of an actual material irritant. Both events are mysterious, yet both are explained so far as may be (although the terms of the explanation differ) when they are shown to be in obedience to more general laws, whether these have reference to function or to structure. That is their ultimate analysis.

While, therefore, there is no antecedent objection to the term 'functional' as applied to disease, but, on the contrary, an obvious need and place for it, it is not every disorder of which the material element is unknown that can rightly be admitted, even provisionally, into that class. The diagnosis of functional disease, as such, is not always easy. It requires, in fact, an intimate knowledge both of the limits of function, and of the causes on which its variations depend. No disorder can properly be called functional unless it fall within these

limits, and unless the causes which are competent to produce its particular phenomena are known to have been actually in operation. Thus, for example, the symptoms of extreme bodily fatigue are often enough misinterpreted, and are only to be distinguished as such by a full acquaintance with the proper signs of fatigue, coupled with the knowledge that excessive bodily exertion has actually been undergone. Wanting the over-exercise as cause, or finding other symptoms in addition to those which are properly induced by exhaustion, the theory of functional disorder fails. We have then to hypothesise some *material of disease*, however vague and uncertain our actual knowledge as to the nature of that material. In other words, so long as the organism remains obedient to its excitant, exhibiting no more than that deviation from its usual method which is commonly recognised as its proper response to the extra strain to which it may be subjected, so long we have that *kind* of disturbance (of whatever degree) which the term 'functional' accurately describes.

The application of these principles will be best seen by reference to the class of affections of which

the following pages treat. The human organism is there regarded from the side of its mental and motor endowments, with all the variations of these due to age and sex and temperament. In the course of growth the individual is seen to undergo successive transformations, assuming new characters as new occasions arise and leaving those behind that are no longer fitting. These transitions, which are too numerous and diversified to be imputed to organic development alone, concern the whole of life; all mankind are occupied about them. Such is the law of nature, which, like other of its laws, is not without suffering.

It is in these transitions and in this suffering—in other words, it is in the material of every human creature—that the elements of functional disorder inevitably arise. Each stage of life, in turn, is liable to suffer from the imperfection of being that properly belongs to it. The infant readily resents by spasm the material irritation to which it is peculiarly exposed; the girl meets with hysterical emotion that mental perturbation which belongs to her time of life; the woman suffers in the whole tone of her health at each catamenial period. The

natural incidents of life, that is to say, are calculated to affect these persons injuriously, and do habitually so affect them. Such disorders are not to be regarded as mere accidents of life: they are its common incidents, due to inherent defect; yet not the defect of disease, in the sense of structural injury, but of unfinished development or of that natural imperfection of being which is our proper inheritance.

Not less conspicuous than the reflex spasm of infancy, or the emotional outbreaks of puberty, or the periodic tax upon womanhood is the mental depression of sexual decline, or the restricted muscular obedience of advancing life. At every epoch of existence particular characteristics appear in precarious prominence; a certain amount and a certain kind of disorder attending even those periods which are accounted the most secure. Such, I say, is the order of normal life which is only in imagination conceived of as a happy passage from stage to stage. Suppressed, as these disorders are to the uttermost, by a discipline carefully framed to that end, their suggestions and beginnings are still continually appearing, and are to be accounted

for not by any discovery of disease, but by reference to the common lot. In the necessary conflict of life it is certain that the several liabilities to derangement which only await opportunity will, from time to time, be so fostered by circumstances as to break out in riot, and by their prominence soon attain the rank of disease.

We have to admit, moreover, in that wide variability which is implied by saying that no two persons are precisely alike, the possession by some (whether by inheritance or cultivation, it matters not) of certain endowments in excess. Extreme excitability of emotion, extreme readiness to spasm, extreme sensitiveness to pain, where the word 'extreme' denotes only that the individual exhibits more than the average (or what upon our imperfect and partial reckoning we call the average) liability of response to agencies to which all are responsive more or less. It is impossible, upon any strict grounds, to fix the proper limits of this response. Each one fixes his own standard according to age and occasion and local custom; but the line that separates sensibility from over-emotion is no more susceptible of exact definition than is

that which divides a pleasurable sensation derived from sight or touch or movement, from one that is indifferent or disagreeable or actually painful. The same person will experience, at different times, widely different impressions from precisely the same agency. It is proverbial that the regions of laughter and of tears are conterminous and that the most acutely pleasurable sensations are the most readily converted into pain. The healthy measure and quality of response might, indeed, be supposed to be that which is found the most convenient; yet no one will assert that the individual who is most insensible to emotion, and the least moved through the medium of his special senses, is the best representative of healthy organisation.

But besides the excessive exhibition, whether from inheritance or cultivation, of what, for the present purpose, I have called the normal endowments, and besides the precarious tenure of these at particular periods, there are other necessary conditions of life which tend to remove the individual from that typical perfection of existence which some imagine for him so long as his body is undamaged. How much divergence from normal

integrity is implied, for instance, in habit, custom, and association whereby the natural freedom gets restricted, and both mind and body directed and narrowed to certain uses. Thus particular muscular acts, at first wholly voluntary and within will-control, become by a certain number of repetitions involuntary and automatic. The habitual use of muscles in a particular combination soon renders certain of these subservient to the others, so that the activity of one calls up and compels the rest. These are laws of our nature which we could by no means have predicted and which no anatomical search could discover. We cannot conceive of mankind apart from such conditions, nor of the conditions themselves without perceiving their attendant consequences. Serviceable as they are in rendering intricate manual acts easy and spontaneous, and in permitting muscular movements without mental co-operation, they cannot render such service without at the same time crippling the freedom of the will and impairing the native variety and independence of muscular action. As in the beneficial working of the law we get mechanical dexterity and useful automatic movement, so

in its pernicious working we get disfiguring muscular habits and restricted adaptability of muscles to new uses.

To these sources of derangement from within others must be added from without. The circumstances in which we exist are not those that suit us the best. Passions and emotions continually interrupt the orderly course of organic life. In the presence of many injurious atmospheric agencies, it is only by artificial aids that existence is maintained for a while with but a gradual deterioration and a tolerable amount of disorder. Not seldom external influences, which are never wholly on our side, become so actively hostile that over large tracts of the globe it becomes the rule to suffer and even, as in the many desolating epidemics of Europe, the rule to perish.

With disorder thus intimately interwoven with the fabric of life there is yet a further disturbing element, in that mysterious kinship with disease which distinguishes hysteria. A large number of persons, typically healthy from the anatomist's point of view, will so exercise their imaginations as to produce the semblance and experience some of the actual sensations of illness. That watchful personal

control which, at the best, hardly suffices for its purpose, is with these replaced by a restless craving after the material for disorder and the opportunity for emotional display.

We have to regard the human organism, therefore, not as it is formed by nature, but as it is deformed by use; not as it is in itself, but as it is made by its environment. The freedom and liberty of choice which seem, at the first, to belong to it get weakened by the force of custom and the bias of some particular indulgence. There is no perfection of being; only certain avenues of escape and modes of discharge are provided for the disorders we are destined to endure.

It is true, indeed, that everyone has his own notion of 'the sound mind in the sound body,' picturing to himself, more or less clearly, both typical health and the several degrees of declension from it, until the exact point is reached where he would have 'disease' begin. But the demarcation is a perfectly arbitrary one, and corresponds with nothing that is in nature. 'Health' means to you or to me that particular measure and manner of response and general behaviour which each of us, from his own point of view, happens to regard as

the best and fittest. 'Disease' is, for both of us, any departure from that condition. Anyone is at liberty to invoke names like these. They have been bequeathed to us, like many more, with no conditions attached which we need at all regard.[1] You may recognise 'disease' in whatever quickens the heart or flushes the cheek, since every such event implies material change and is calculated to produce lasting mischief; or you may say, on the contrary, the variability of function under appropriate stimulus is so wide that we cannot identify disease till we meet with its material products. In the one case you hypothesise an individual who is only in health in a particular mood and a particular set of circumstances which you choose to assign him. In the other you make functional variation of itself a source of suffering and even a cause of death.

We are to consider disease, however, not as it is presented to the mind upon considerations of logical consistency, but as it is brought under our eyes in all the ills, physical, mental, and moral,

[1] Men having baptised observed facts with a comprehensive name, forget the process of baptism, and suppose the name to represent a mysterious agency. (G. H. Lewes, *Physical Basis of Mind*, p. 65.

which we are called upon to remove or alleviate. Of such ills a large number concern alone, or concern first of all, the nervous system. No small portion of these are to be immediately traced, not to material change, but to want of control on the one hand or excess of strain on the other. They take rank among diseases on the simple ground of their inconvenience and need of correction, and include instances of emotion unrepressed by discipline, of habits grown inveterate by indulgence and hereditary transmission, of function overtaxed at that time of life when its burden is already too heavy. To this class especially belong the disorders with which we are now concerned. We shall recognise their real nature the best by considering that the seed from which they spring is to be sought in the texture of normal life, that the individual is meant to suffer, and that with his growth the elements out of which his suffering is made do not disappear, but get readjusted.

In thus regarding the facts before us, we are not to dissever functional derangement from structural, but only to deal with each in the order of its

appearance. Functional disorder comes to be considered as such, before its material equivalent can be even conjectured. Its consequences have still to be determined upon such evidence as morbid anatomy can supply. It is at the first outset of the disorder, however, before it has resolved itself into formal disease, or obtained a place in official nomenclature, that we can best recognise its source, and most hopefully attempt its cure. In watching for its earliest signal we are continually and of design receding from its material part, dealing more and more with the facts of life, and nearing that point where, from the nature of the case, tissue-changes cannot be directly in view.

And, indeed, if the matter were to be pressed home, it does not immediately appear that the pathology, which makes appeal exclusively to anatomical proof, is of itself complete and secure. In nervous affections, especially, it is sometimes matter of surprise to find morbid appearances of whose date and mode of arrival and ascertained effect nothing is actually known, at once accepted by the histologist as standing in a particular relation to the clinical symptoms and the fatal event. It dis-

turbs him little that nervous lesions of the most diverse kind exhibit upon death the same morbid changes, or that, while it falls to him to correct many erroneous conclusions made during life, he is often unable, from his own side, to form any conjecture as to the life-history of the patient.

It is often said that clinical history and post-mortem observation ought properly to corroborate and supplement one another; but it must be said as well that, to our insight, this correspondence is always imperfect and not seldom altogether hidden. It is only in imagination or in books that the progress of disease can be traced continuously through successive stages, and, for every degree of declension, have a corresponding tissue-change assigned to it. In reality, owing to the necessary restrictions to investigation, we only get glimpses of this chain here and there, perceiving disorder at one time in its relation to function, at another to structure.

The practical question, therefore, in regard to all those conditions of being which are commonly recognised as morbid, must always be, not whether the derangement be functional or organic (for we know that the two are necessarily correlated), but under

which of these two aspects are the particular phenomena in their then stage to be best interpreted. Considered in the abstract each point of view has advantages of its own. The analysis of disease in its functional relations, if less complete than the other, has that security from error which arises from following a single clue. The data of the problem are expressed in the same terms throughout; while the facts appealed to, if only they will serve, are exhibited in their life and integrity without undergoing in the analysis that process of dissection which implies death and may involve mutilation.

And there is another advantage. This referring of morbid phenomena to inherent beginnings, attributing them to excess, or defect, or misarrangement of that which is already present, and not to the addition of something new and foreign, is, for the functional side, in strict correspondence with that arrangement of structure-changes which distinguishes homologous from heterologous growths. By both representations alike the idea of disease as a separate entity is rejected, and the whole series of vital operations get comprehended in a single view.

CHOREA.

LECTURE I.

DESCRIPTION AND MODE OF ORIGIN.

DEFINITION—VARIETIES—ESSENTIAL CHARACTERS OF CHOREA—CONNECTION WITH RHEUMATISM—WITH MENTAL DISTURBANCE.

GENTLEMEN,—The subject of these lectures hardly needs formal justification. It will not be urged against the discussion of chorea and diseases of the same class, that their nature is already sufficiently understood. Take, for instance, these three affections, whooping-cough, chorea, hysteria, and observe how wide is the difference of opinion in regard to all of them. As to the first, the prevalent belief (and that which the State sanctions in its official Returns) connects whooping-cough not with nervous diseases, but with enteric fever and small-pox. As

for chorea, the assertion that it is a derangement of function is denied both by those who reject that expression altogether, and, more explicitly, by some modern histologists who would derive its symptoms from vascular repletion or minute emboli. And of hysteria, the very name, indicating as it does a uterine origin and consequent limitation to one sex and a particular period of life, is regarded by many as a vicious expression which the facts of the disease sufficiently contradict. These disorders have indeed but this in common—that the names by which they are known are all calculated to mislead. Whooping-cough may exist without any sound of whooping. Chorea has no resemblance whatever to dancing. Hysteria, like hypochondriasis and 'the spleen,' preserves an old and mischievous fancy, which placed moral and mental attributes in the special charge of individual organs.

But while hysteria is a term of great antiquity, recalling conceptions belonging to the infancy of medicine, chorea and whooping-cough are comparatively modern. The old term *chin-cough*, as Dr. Lee mentions, first appears in the bills of mortality of 1678, and for the year 1701 there were in Lon-

don two deaths from it and but one from whooping-cough, while there are now about 4,000. The first description of chorea was that of Sydenham, whose observation so far differs from our own that he speaks of it as 'a sort of convulsion which chiefly invades boys and girls from ten years of age to puberty, showing itself first by a certain lameness or rather instability of one of the legs, which the patient drags after him like a fool.' We have to assume, therefore, in the case of whooping-cough, either that it is a modern disease, or else that its special characters of infectiousness and non-recurrence passed unrecognised through a long series of years; while, in regard to chorea, we must suppose either that the period and manner of its attack have changed since Sydenham's time, or else that this observer was in gross error in his description of what he saw. It is difficult to avoid the conclusion that affections of this class have become more prominent in our day, whether by actual increase, or because our notions alter as to the true limits of disease.

To Sydenham's description of chorea, then, must be added what he failed to see in regard to its

cause and common accompaniments, and what he could not know in regard to its concurrent heart-disturbance. Yet it is possible in the definition of disease to include too much as well as too little. Our own view of chorea may be as erroneous as was Sydenham's, from giving undue weight to exceptional symptoms, and forcing certain accidents of the disease into unnatural prominence. Chorea has to be considered first of all in its customary shape; and no considerations as to its exceptional forms must be suffered to narrow—though it may properly help to define—that first view of it. The symptoms of gravest weight must be those that are found to be essential; those without which chorea cannot be. The pathology which finally obtains acceptance must be that which accommodates the largest number of instances, while it is not contradicted by any.

It is needless to spend time and pains in the description of a disease which is familiar to everyone. Yet, if chorea itself were not within easy reach, the accounts given of it would convey but a feeble picture of the actual thing. Not to mention Sydenham's comparison to the feats of Merry

Andrew (which I cannot regard as particularly happy), to speak of it as a convulsion, as though various groups of muscles were successively agitated by spasm, would describe, at most, those severe forms of the disease where chorea has lost its special distinguishing characters. Ordinary, childish chorea is not convulsion, though it may become so. No formal terms convey a notion of it half so well as the word 'fidgetiness.' Whoever can picture to himself a shy and restless child placed in circumstances of embarrassment will picture chorea; whoever can heighten the picture, conceiving of a greater degree of restlessness and confusion than ordinary shyness produces, *but no jot of change in the manner of either*, will have before him chorea of no mean severity. The difference between this kind of muscular disorder or over-movement and true spasm is best seen in the working of the muscles of the face. Anyone can imitate the facial restlessness of the choreic child: no one can imitate the facial distortion of the epileptic. Common chorea exhibits muscular fidgetiness and unrest. And as every child may serve to remind us of chorea, so, too, in tracing the mental and bodily development

from youth to maturity we get further and further off from it, until in old age we reach its counterfeit, when the full muscular control of manhood becomes disfigured by an involuntary trembling.

It is necessary to dwell upon these characters of chorea, because other affections, differing from it in symptoms, and origin, and ultimate fate, have been called by its name. There is, for example, the so-called 'electric chorea' of Milan, where the very high mortality, the rhythmical character of the movements, the presence of fever, and the adult age of the patients, are all in marked contrast to our own childish chorea. I would even venture to maintain that the instances of involuntary muscular movements quoted by Dr. Radcliffe in his well-known paper upon this subject in Reynold's 'System of Medicine,' are not instances of true chorea. There is, at all events, enough in the child's affection of that name, in its guise of exaggerated restlessness, its disposition to come and go, its association with mental disturbance and with rheumatism, and, above all, in the heart affection that goes along with it, to justify the exclusion of cases that have none of these characters. So,

again, muscular twitching and instability, where either a particular muscle of the face is repeatedly contracted, or the head is kept in continual oscillation, are phenomena interesting, as I shall try to show, as illustrating the pathology of chorea, yet differing from the chorea we have now to discuss.

This notable feature in chorea—that its movements are neither rhythmical, like the 'electric,' nor intermittent, like the twitching which habit so easily generates—is fully recognised by writers who would yet seek for some vascular explanation of its phenomena. 'Let it be granted,' says Dr. Dowse in a paper upon the subject,[1] 'that in chorea we have *something unique*—movements, in fact, which can scarcely be called tonic or clonic, without rhythm, uniformity, or regularity.' Nevertheless, these movements, difficult and anomalous as they are to the pathologist, are sufficiently familiar to mothers and nurses. By coaxing, or diverting, or alarming a shy little child you may produce a miniature resemblance of the main characters of the disease.

[1] *British Medical Journal*, January 13, 1877.

I hope to be excused for dwelling upon these preliminary points. The necessity for doing so arises out of the many attempts to construct a pathology of chorea from its exceptional examples —a pathology which requires, for instance, that the affection should be sudden, or one-sided, or involuntary, or consequent upon cardiac imperfection, or upon anæmia; whereas the notorious fact is that such cases as these err from the common rule.

The chorea that I have before me is an affection of childhood, exhibiting, as I have said, in exaggerated degree those characters of fidgetiness which belong to the child by nature. It is so far obedient to control that by an effort on the part of the patient the movements can be quieted for a while, although the period of calm is apt to be followed by increased disorder. Similarly, when the attention is fixed on something external, or when the mind is engaged in settled musing apart from itself (a condition rare and difficult with children), the movements are at the least; while with the opposite state of mind—self-consciousness or embarrassment—they are at the greatest. It is easy,

moreover, even with chorea of some violence, to hold an arm or a leg with sufficient firmness to prevent chorea so far as that limb is concerned. But the agitation, thus forcibly arrested in one place, will be transferred to another, so that the sum of deranged movement is not lessened. The affection, although seldom one-sided, is commonly partial; certain muscles, that is to say, escape—the face, or the legs, or the speech, or the heart (according to no anatomical rule, yet after a law, as I think, which is not capricious); and of the muscles that are implicated all do not suffer in equal degree. The more disturbed limbs, or those in which disturbance lasts the longest, become eventually weakened, the loss of power being sometimes very obvious. Yet there is no actual palsy (I speak of the rule, and not of the very rare exception), nor arrest of nutrition, nor loss of tactile sensibility, nor of electric response[1]—no permanent change, indeed, of any kind. The weakness

[1] It is stated by Dr. Gowers and other observers that choreic muscles exhibit sometimes an increase of irritability, both to faradic and voltaic stimulation. I can certainly affirm that this is not an invariable phenomenon. That it should occur sometimes in chorea of long standing, and as a result of altered nutrition of the motor

has all the characters of fatigue, and none of the characters of partial paralysis from nerve-lesion.

Upon these main features of chorea (with others, less common, to be mentioned in their place) I shall venture to insist, yet without ignoring the fact that the disease is occasionally one-sided, that it may become a quite involuntary spasm; and that it has been known to end in paralysis and even in death.

And except that the subjects are children between four and thirteen, and in a very large proportion of cases girls, I know not whether we can safely indicate what manner of persons chorea will seize by preference. Sir Thomas Watson has observed that children with dark hair are 'much more frequently attacked than others,' and believes he has seen the same remark in a book. Dr. Dickinson, on the contrary, is of opinion that a predisposition can be recognised in children 'whose pink-and-white complexions and colour of hair give them what is

cells of the spinal cord, seems probable enough. Such evidence of altered nutrition might be expected as a direct result of excessive limb-movement. We may fairly decline, however, to accept the view that this increased muscular irritability is due to 'an irritation transmitted downwards from the diseased cerebral region'—a statement involving many assumptions.

known as the Saxon type.' It has been attempted, with little success, to associate the disease with scrofula and with syphilis. The familiar doctrine that would make children so affected the ready prey of a great variety of ailments finds but little support from the history of chorea. It is very indifferent to diathesis.

It is not altogether the same with temperament. Just as the less stable sex suffers in large excess, so, taking both sexes together, it is the least stable age that suffers most and worst. Yet the emotional element is not always prominent in chorea. Children will sometimes exhibit a stolidity and general indifference singularly inappropriate to their age, and making them very like men. They are not on that account safe from chorea. I had charge lately of a girl of thirteen, in her fourth attack of it, who, to all appearance, is heavy and unexcitable. I had also a boy, with severe and protracted chorea, who, in respect of imperturbability and precocity, resembled the youth of the London streets. It is very necessary to bear such examples in mind, lest at the outset the field of inquiry should be unduly narrowed. Although the

emotional element is very largely represented in chorea patients, the disease embraces a great variety of temperament, and, except it be for rheumatism (whose claim in this respect we have yet to consider), is remarkably impartial in its choice of subjects.

The relationship between chorea and rheumatism was first asserted, I believe, by Dr. Copland. It has been accepted in this country and in France (hardly so much in Germany), and in some quarters has almost displaced the older belief in the efficacy of mental causes. I think I am accurately representing the prevalent opinion upon this subject by saying that it recognises two main causes of chorea, the one *rheumatism*, the other *fright*; admitting, at the same time, that a large number of the cases arise in neither of these ways, and are, in fact, unaccountable.

Now, turning to the statistics, I have to refer very briefly to four separate series of cases, comprising together 124 instances of the disease. These were taken consecutively, except in the one series that relates to fatal cases, where the only selection had reference to that result. Of 22 cases

(the first series) coming under my own observation, the origin of the affection was 'doubtful or unnamed' in 13 (in 2 of these there being good reason to believe in some emotional cause); *fright* was the alleged cause in 5; *acute rheumatism* in 1. Of the remaining 3, 1 had chorea *concurrently* with acute rheumatism (the former being attributed to fright), 1 had chorea *first* and acute rheumatism *afterwards*, and in 1 the chorea seemed due to the irritation of round worms. Of the 13 first named, where the cause of attack was unknown, 'rheumatism' was present in the histories of 7, *not in near connection of time with the chorea*, and 'acute' only in one instance.

Secondly, in a series of fatal cases tabulated by Dr. Dickinson ('Transactions of the Royal Medical and Chirurgical Society,' vol. lix.), where the total number is again 22, there are 12 of *doubtful or unnamed* origin, 4 are *immediately connected with fright*, and 2 with *other mental disturbance*. *Acute rheumatism* occurs *as the cause* in 3, including one where there was an interval of three weeks; it happened subsequently to the chorea in 1. Of the 12 first named, where the cause of attack was unknown,

'rheumatism' was somewhere in the histories of 3.

In a third series, derived from the practice of the same physician at this hospital, including 71 cases (*not* 70 as stated in the paper), there are 23 of doubtful origin, *where rheumatism may be absolutely excluded*, and 16 were preceded by fright. Of the whole 71, 'rheumatism' is in the history of 17 (it was 'acute' and immediately preceding in 5, 'acute' but not connected in time in 1), *fright* is *in the history* of 25, and some mental emotion was rendered probable in 6 more; 9 were equivocal.

Taking, however, a fourth series of 9 consecutive cases, admitted into my wards at the Westminster Hospital (the average of age being somewhat older than at this hospital), there is a distinct account of *fright* as the immediate cause in no less than 7; the two exceptions being a boy of twelve, of violent temper, who had had acute rheumatism some months before; and a girl of nine, who had had rheumatism two years before, and was now in her second attack of chorea, of which the severity of school discipline was the alleged cause. There is no 'rheumatism' except in these two.

Taking these four series together, we have 124 cases where (dismissing other mental disturbance altogether) *fright* was the immediate cause in 32; *acute rheumatism* happened *before*, or *with*, or *after*, in 15 (occurring as *immediate cause* in 10), while 'rheumatism,' not acute, is *in the history* of about 21 more. Not to defraud rheumatism, however, let us admit every instance wherein this somewhat vague expression is made use of, against every instance where *fright* is mentioned *as immediately preceding the chorea*. We then get, out of the 124, 36 to the *rheumatic* account, against 32 to the *fright* account.[1]

Such being the naked statistics, it behoves us, before accepting them as absolutely true, to consider the circumstances of the case, and especially to give some account of the large number of instances of chorea which in every enumeration are

[1] A *fifth* series, completed since the above was written, would make the total number 143, with 38 to *rheumatic*, and 34 to the *fright* accounts in the sense used above. I do not assert the *precise* accuracy of these figures. There is a contention of causes in some few cases, where, for example, both fright and rheumatism figure together, and the immediate cause of the attack must be left to conjecture. Errors of this sort are not likely to be so numerous or one-sided as to vitiate the general conclusions.

counted as '*spontaneous*.' As regards the frequency of rheumatic chorea, it behoves us further to consider—

1st, That children are subject to many pains (growing pains, and other unscientific disorders) certainly not rheumatic, yet, in the present state of opinion, eagerly seized upon afterwards as evidence of rheumatism.

2ndly, That cardiac murmurs, heretofore regarded as deposing in favour of past rheumatism, are now known to be due as often to the chorea alone. We are rid of the error, but not of its consequences. Much of the belief of the connection between rheumatism and chorea (whether true or false) has thus been built up out of improper material.

3rdly, That pain of great acuteness, and sometimes attacking a joint, often precedes the muscular disorder as part and parcel of the chorea itself.

And, lastly, that the support to be derived from published cases for any received belief is always likely to exceed the fact.

In illustration of these remarks, I would men-

tion here a case to which my friend and colleague Mr. Richard Davy was good enough to call my attention the other day. A girl of eleven was brought into Westminster Hospital with acutely painful and tender knee-joint. There was neither swelling nor effusion to account for this pain, which, in effect, very shortly subsided abruptly on the appearance of chorea. A similar case came under my observation some years ago, where acute pain in the hip of a little girl suddenly departed on the appearance of chorea. In a third (also a girl), pain, referred to the heart and of extreme severity, ended in the same way. Of these three examples two, no doubt, will be put down hereafter to rheumatism; yet in all three the character of pain resembled rather that which is associated with hysteria. Quite lately I came upon a case of chorea counted as rheumatic, but where upon strict inquiry the preceding rheumatism resolved itself into the limb-pains of an influenza cold. At the present moment, and for the last year, I have had care of a boy of ten with apparently incurable chorea, who suffers acutely, and especially at night, from pain in the arms.

And observe how the readjustment which these considerations and examples demand, while it is so much to the loss of rheumatism, is so much to the gain of mental disturbance as a cause of chorea. Acute rheumatism can never be overlooked, while much that is not rheumatism at all is very likely to be taken for it. Sub-acute rheumatism, indeed, (which, very suspiciously, is more frequently associated with chorea than the other) is an expression often made use of for any obscure limb-pain.[1] Mental disturbance, on the other hand, is very apt to escape our attention; in all but its simplest forms, indeed, it is beyond the child's power of expression. Keenly interested as children are in all that is passing around them, subject to continual surprise and disappointment, and strong revulsion of feeling, their means of giving expression to their emotions are extremely limited, and such means as they have are reserved for very limited use. Quite

[1] Those who have filled the post of Registrar at a large hospital, where every case admitted has to be classified under some official heading, will bear witness to this, and to the fact that 'sub-acute rheumatism' not seldom develops into some definite disease, of which it then appears to have been in fact the earliest signal—into chorea amongst the rest.

unable to give any word-utterance to sensations which they yet feel with sufficient acuteness, remorse, pity, just indignation, the sense of injury—their single symbol for all depressing feelings is tears; and these they reserve almost entirely for the expression of sorrow or alarm. The violent and uncontrollable screaming of childish passion (the likeness of which to mania is overlooked in its impotence) is without tears. In more advanced life, and especially with women, this one sign—weeping—is of much wider signification. Although these latter are provided with so many more avenues for emotion than children—language, facial expression, imploring or defiant attitudes, and the like—yet they employ tears for a variety of uses, and under many different states of mind.

In this dearth of expression-outlet, which is in itself a source of irritation, many of the emotions of the child escape recognition, while some are misinterpreted. Vague sensations of uneasiness get expressed in terms of physical suffering; much that is not actual pain very easily passes for it.

Such considerations (assuming only that mental impressions have anything to do with causing

chorea) would lead us to believe that various kinds of emotion were associated with a larger number of cases of chorea than appear upon record, be that number large or small; the more so when it is remembered that, as causative of chorea, all mental impression is by custom restricted to the single impression of fear. Yet, even with this arbitrary limitation on the mental side, and with no limitation whatever to 'rheumatism,' it still appears that *mental impression figures in statistical tables as being as potent a cause of chorea as rheumatism.* How would it be if we put these two causes on the same level—fear against rheumatism?—if, after asking, 'Has the child ever had rheumatism?' we put the parallel question, 'Has the child ever been frightened?' The effects of fright are as apt to linger as the effects of rheumatism. It is in the nature of a nervous impression to be renewed over and over again in all its original strength when circumstances arise to suggest it. There are sensations which never grow dim, which start up afresh unbidden at a sight or a smell with no train of thought to lead up to them. Everyone who knows children knows how easy it is to move their light

minds by the same expedient repeatedly; how the same story of wonder or horror will excite corresponding emotions over and over again upon each repetition.

The fact that in a large number of instances of chorea there is *an interval* between the assumed cause and its effect seems thus easier to provide for in the case of fear than in the case of rheumatism. The rheumatic origin of chorea depends upon the hypothesis that 'the rheumatic poison' can produce this amongst its other results—as, for instance, it produces delirium. 'The connection,' says Dr. Handfield Jones, 'seems to me most naturally explained by regarding the motor disorder in just the same light as we do delirium.' But, if that were so, why does not chorea, like delirium, happen *along with* rheumatism? The delirium of acute rheumatism is a part of it; when the rheumatism is past the patient is no more liable to delirium than anyone else. Chorea, indeed, as a motor disorder, has its mental counterpart in mania rather than in delirium, as Dr. Maudsley has pointed out. Both in time and manner, therefore, it is rather to be likened to those

maniacal attacks which sometimes interrupt convalescence after acute disease, and of which there are striking examples in the case of pneumonia as well as of rheumatism.

These considerations, I say, taken along with the statistical fact that a single mental emotion—fear—is productive of as much, or nearly as much, chorea as the rheumatic habit, compel the admission that mental causes are more potent than rheumatism.[1] And not only so, but we are entitled to

[1] During the last year (*i.e.* from September 23, 1876, to September 23, 1877) 31 cases of chorea, from the hospital in Great Ormond Street, have been under my charge at the Children's Convalescent Hospital at Highgate. The numbers are small; and they are so deficient in the rheumatic element that, knowing the inevitable tendency to make history support one's own conclusions, I should hesitate to quote them had I not received the account of each from the notes of Dr. Garlick, the Medical Registrar. They are as follows :—Rheumatism (not acute) was made out in 2. It was 'doubtful' or 'very doubtful' in 3. There were of 'rheumatic family' 2. Reliable history was wanting in 5. Rheumatism was certainly excluded in 19. On the other hand, mental emotion appeared as cause in 10 (extreme terror in 7 of these); it was the probable cause in 2 more. Debility after measles and 'low fever' respectively was the supposed cause in 2. In 1 the father was insane. The remaining half (15) were not accounted for on any mental ground.

I may here mention, by way of comparison, that my friend and colleague Dr. Horatio Donkin very kindly, and without *arrière pensée*, undertook an inquiry into past rheumatism in 34 out-patient children taken consecutively, none being choreic. He satisfied himself of the occurrence of rheumatism in the past histories of 5 of these.

say of the 'spontaneous' and unexplained cases that, *while rheumatism may often be excluded for certain, mental impression can never be excluded for certain.*[1]

We have then chorea, considered in reference to its cause, divisible into three classes—first, is that which arises out of mental impression; next, that which is connected with 'rheumatism,' and less often with acute illness, as scarlatina and measles; and thirdly, the chorea which we call 'spontaneous,' but in regard to which, as I have just said, we can never certainly affirm that it is not of mental origin. Yet, be the source of the affection what it may, chorea once started runs a course of its own. Seldom recognised at its very beginning, the interval between cause and effect is really narrower than appears. Children are not so handy and dexterous that slight errors in ordered movement should at once be put to the score of

[1] Almost always, indeed, there is something or other in the history of these 'spontaneous' cases very strongly suggestive of mental origin—*e.g.* the child is the weakest of the family. How often are we told this, and how much is implied in it, especially with the poor! Such a child, in having to take its part in the common games and exercise, and schooling, is continually subjected to injurious because excessive strain.

disease. Rather is the patient deemed careless or perverse. She drops the crockery, or spills the milk, or at school goes back in her writing. These failures, being for the while misunderstood, are met by punishment and derision. From such treatment the child not only loses the confidence which is necessary for the regulation of all muscular acts, but endures as well the mental suffering arising from a sense of injury. Thus, the consequences of chorea become the cause of more chorea. We have here the material out of which muscular instability, so slight as to be beyond the domain of disease—a mere habit of awkwardness bred of some passing cause—is so nursed and fed that it grows into a general disorder which nothing but time and increased mental strength will cure.

In these respects, as in others, we have to observe that the pattern of chorea is always the same; or, more truly, that chorea attacks, of whatever origin, are inextricably mixed. You cannot say, for example, the chorea of fright will be severe, that of rheumatism trivial, or one sort will affect the legs, another the arms, or one kind will recur and another will not. The difference is made by

the difference in the subjects. Thus, while the method of the motor disorder defies scientific description and has to borrow from the phraseology of the nursery, its classification is not less difficult. In the uniformity of its symptoms there is strong reason to suspect that its prime motive is always the same. We may at least hope by a careful analysis of its several phenomena to discover some common element in respect of which all its causes agree. To such analysis I shall ask your attention in the next lecture.

LECTURE II.

MUSCULO-MENTAL PHENOMENA.

EXTREME CHOREA—THE ORDER OF MUSCULAR INVASION—ASSOCIATION WITH EMOTIONAL SPASM—WITH OVER-STILLNESS—WITH HEART-DISTURBANCE—THE MUSCULAR EXPRESSION OF EMOTION AT VARIOUS AGES—APPLICATION IN DISEASE.

GENTLEMEN,—You will say, perhaps, that I underrate chorea, making an estimate of it which leaves out of sight the most marked and severe cases. Acute chorea, it may be urged, in its full development is a violent jactitation and tossing about of the body, where the will is altogether powerless, where there is true spasm, and where sometimes the mind itself participates in various measure, from a blunted intelligence to a very active delirium. It is but a difference of degree. The will-power, always impaired in chorea, is in the worst instances quite mastered; the mental faculty, often engaged, is quite exceptionally as much disordered as the muscles. The factors are

still the same; but they are variously combined, and in the combinations the several relations of the affection find expression. I know not on what ground these grave and sometimes fatal cases are to be called 'acute chorea;' for they are not usually pyrexial, and not necessarily of short duration. 'Acute' would here mean 'severe;' a new use of the word, yet not otherwise harmful. But to speak of such chorea as the 'most marked' is not true. The most marked chorea is that which we have been contemplating—that which conforms to the common pattern. These others represent chorea in unnatural exaggeration; not what it is wont to be, but what it may come to in exceptional circumstances. Its common character is no more to be judged from such instances than is the common character of rheumatism to be judged from cases where there is extreme body-heat or very active delirium.

Yet they are not on that account to be left out of the reckoning. Spasmodic involuntary chorea, arching the back and tossing about the limbs, is almost always but a part of ordinary chorea. Either the muscular spasm has developed out of the half-

voluntary disorder, or it eventually tones down to it. A continuous clonic spasm, wholly removed from the will and quite uninfluenced by emotion from first to last, would not be recognisable as chorea at all. If, for once, we might disregard the universal practice of dividing every disease into three, it would be useful to distinguish chorea of two degrees. First, that in which the influence of the will, the play of the emotions, and the effect of attention were all perceptible more or less—a class comprehending the very great majority of all the cases. And, secondly, chorea of that rare severity where, for the time, volition altogether disappears and the body is unceasingly agitated by clonic spasm.

Yet even in this extreme condition does it ever happen that the convulsion is altogether removed from mental influence? From mental control it is, no doubt; but I question whether mental impressions ever altogether lose their sway, or that convulsion continues unvaried by this cause over any long period of time. Between these two stages of chorea, the quasi-voluntary and the convulsive, certain morbid changes may intervene, upon whose

occurrence the development of actual spasm immediately depends. It has been shown by Dr. Dickinson and others that the structural lesions of chorea are to be found besides in a large group of nervous disorders. Hyperæmia, itself the result of choreic disturbance, may, in its turn and by the perivascular destruction to which it leads, introduce results of its own. Movements, at first intermittent, changeful, and half voluntary, may thus eventually become continuous and spasmodic as these secondary changes ensue; or chorea of one side may become converted into convulsions of that side. We have experience of both events. It is not necessary, however, to assume that these structural changes occur always. In ordinary cases, indeed, where the disturbance is slight and short, and the normal functions rather enfeebled than lost, it is difficult to conceive of actual destruction of any sort. The ever-varying chorea of childhood which any sudden emotion may excite (and not only excite, but sometimes, as in a case quoted by Dr. Hughes, as suddenly cure) cannot have this structural basis.

Let us consider, however, before discussing

chorea from the side of morbid anatomy, some of the salient features of the affection in life—the rule and method of its muscular phenomena; its association with heart-disturbance; the disorders that concur with it or take its place.

The great majority of cases of chorea happen, no doubt, between the ages of four and thirteen or thereabouts, from the period of second dentition to that of commencing puberty; the age of ten (at which Sydenham places its commencement) being, in fact, the time when it begins to decline. Yet there is no absolute limitation of age, except this: that chorea is *impossible in infancy.* Limbs that have not been put to set use—the legs in walking or crawling, the arms and hands in reaching and grasping—cannot be choreic. They are very prone to spasm; they are sometimes affected with tremor; they can never have chorea. For this latter there must be purposive movement, as there must be speech for stammering. In this sense, although it is true that paralysis may succeed chorea and muscular weakness is its very common sequel, actual palsy is incompatible with it. It is the muscles that are being taught to execute move-

ments—that have learnt, and still retain, a certain degree of use—that become thereby, or at last thereupon, not only subject to chorea, but in the highest degree liable to it.

In this relation it is interesting to observe that those who are congenitally deficient in mental respects, idiots whose higher development has been arrested, and who want the full power to direct and co-ordinate their movements, do not get chorea. They are epileptic in very large number, but not choreic. Dr. Grabham, the resident physician at Earlswood, who replied with much kindness to my inquiries upon this subject, tells me that he has 'never seen true chorea supervening upon idiocy.' It is to be remarked, further, that children away from civilisation and who are suffered to grow up in their own way, with little or no training, are indisposed to take chorea. I learn from my friend Mr. Macnamara, of the Westminster Hospital, that in the statistics of Calcutta and up-country practice in Bengal the affection is very rare.[1]

[1] It deserves notice that nothing resembling chorea is to be seen among the lower animals. A nervous affection of dogs has, indeed, received the same name, but it is expressly stated by those that have described it that the name does not apply. The nearest approach

As regards the order of the chorea invasion, it is found (and this with such frequency that I need not quote statistics) that of the limbs the hands and arms of children suffer in much larger proportion than the feet and legs. The rule is, as you know, that one hand, or one arm, or shoulder—right or left—begins, and its fellow soon follows, and next the legs; the face-muscles, with the exception of the tongue *when it is ordered to move*, joining in sooner or later. In young children the facial muscles often escape altogether. Whether it be the right side or the left that suffers most or first, I have not yet been able to satisfy myself. There can be no great difference; yet here, as I think, the operation of a law is to be observed. In that exceptional form of chorea that remains throughout one-sided, the seat of the first attack remains the seat for subsequent ones. I have at this time a girl of fourteen with her fourth attack of one-sided chorea, every attack having been on the right side. Although, as has been said, the legs are usually affected after the arms, they begin

to chorea is to be found in the faces of nervous monkeys, yet it is but a faint and partial resemblance of the human disorder.

earlier to recover. I have seen lately two severe cases of chorea in boys of thirteen, beginning in the hands. Both were quite incapable of walking, and in both the disease yielded but slowly; but it left the legs first, and so rapidly as for the moment to give colour to a belief that the patients were about to make a sudden recovery. Rarely chorea will begin in the legs, but it is never confined to these limbs, and such cases are usually both general and severe.

From the fact that chorea can only happen to muscles which have been intelligently employed, it follows of course that the range of vulnerable muscles increases as life goes on. Until the organs of speech begin to be used as such there can be no speech-chorea (the affection of the tongue, as has been said, is peculiar, and seen only when it is moved to command); until the face is exercised in expression there can be no face-chorea, while afterwards, when expression begins to centre there, it becomes of all localities the most liable to it. In the chorea of approaching puberty, the face, I believe, is always affected, as it is said to be in the chorea of pregnant women, which is often, as

Dr. Barnes points out, but a revival of the same affection in childhood.[1] But, whatever the special seat of chorea, it will readily yield its place when the affected muscles can be held, the disorder being then transferred to some other part.

Cases occur now and then which the nosologist might decline to call chorea, yet wherein some of the elements of the disease are displayed under interesting and instructive modification. Thus, for example, the muscular disorder, instead of being continuous and only increased by emotion, may be intermittent and entirely subject to that cause; or, again, over-movement may be replaced by over-stillness, or, as it is more learnedly expressed, 'chorea may be complicated with catalepsy.' I have a country youth under my care at the present time in Westminster Hospital, a farm labourer, of ordinary intelligence and robust health, who, when addressed, or rather when about to make reply, has an agitation of the right arm and shoulder, which of himself he cannot restrain. Yet there is no want of co-ordination in that limb. He is right-

[1] See Address *On Obstetric Medicine* (*British Medical Journal*, August 18, p. 211).

handed, and his writing is better than with most of his class. When his arm is held, or when the boy is carrying a heavy weight in that hand, the opposite side takes on the movement instead. If he is made to speak continuously, the right arm being held the while, not only is the movement transferred to the left arm and shoulder, but, as he continues his task, the agitation spreads until all the limbs are choreic, and at length his voice and face betoken true mental emotion. When the patient is told to keep his left (or still) arm in continuous motion to and fro, questions may be addressed to him without causing the usual movement of the affected side; and in the ordinary talk of the ward, when not under observation, the movements are but slight.

An instance of catalepsy with chorea I take from Dr. Handfield Jones's[1] valuable treatise:— A girl of eight and a half, who had never had a trace of rheumatism, who was emotional, and tall for her age, was admitted with moderate chorea. Gradually she became quite helpless, 'lay in bed like a statue, almost voiceless, and vacant-looking.

[1] *On Functional Nervous Diseases*, p. 376.

It was a strange sight,' says Dr. Jones, 'this fair, large-eyed girl, lying there day after day so unnaturally still and silent.' Yet in six weeks this child could walk by herself, and in less than two months was 'almost quite well.'[1]

How are these several kinds of muscular disorder to be explained? Why do they so often begin at the hands, and not rather in the limbs of one side of the body? Why does the derangement attach itself particularly to young girls; and why, as these patients grow, do they become less liable to chorea in its pure form of a mere movement-disorder, while still subject to a more localised affection in over-movement of the face mixed with emotional disturbance or hysteria?

Before attempting to answer these questions I must allude briefly to another symptom of chorea. Unobserved until lately, it is made now, in the

[1] A child (aged six) has lately been under my care recovering from chorea, who exhibited remarkable fixity of attitude, inasmuch as that she would maintain for a considerable time any posture, however inconvenient, in which she was placed. Thus she would remain quite motionless with both arms extended and the head thrown back, and at ordinary times, although not actually cataleptic, was 'unnaturally still,' even for an adult. Moreover, when set to walk she seemed to want spontaneity, would soon stop, and only after repeated halts and several biddings get round the table.

judgment of some, of paramount importance, inasmuch as it is said to afford a key to the pathology of the disorder. I allude to the heart-signs.

It is not easy by figures to show the exact frequency of heart-disturbance in chorea. Observers vary in the faculty of detecting very slight departures from the evenness of cardiac rhythm. It is enough that all agree that it is of very common occurrence. In 121 cases (Dr. Dickinson's and my own taken together) it was found in 79; while in 66 cases quoted by Dr. West a 'cardiac bruit' was present in 25. It is shown from post-mortem evidence that such murmurs depend upon structural changes. Thus, of 31 fatal cases, of Drs. Ogle and Hughes together, there was fibrinous vegetation or deposit on the valves in 18. In Dr. Dickinson's 22 there were recent vegetations in 17 (upon the mitral valves in all, upon these *only* in 7), or, excluding 5 adults, there was valvular disease in all but 4 out of 19.

In the great majority of young children with chorea the heart's rhythm is disturbed both as to the sounds and as to the intervals. Successive 'first

sounds' are of unequal length; one will end with an echo, and the next with a murmur; while now and then, if the listening be prolonged, the heart will be heard to falter. From this condition to one of marked irregularity and loud (yet always variable) mitral murmur there are many gradations, all of which will sometimes be observed in the course of a single case.[1]

It is not fanciful to speak of this cardiac disturbance as choreic. It is, in fact, disordered muscular movement, which often both begins and ends with the disorder of the voluntary muscles. It will occur alike in the rheumatic and the non-rheumatic, in the severe cases and the slight, the cardiac muscle seeming all one with the others, suffering or escaping just as any particular group of these may do. Like them, too, the heart will shake off the affection and escape its consequences. For although cardiac murmur originating in chorea will sometimes persist, so that in a second attack the same murmur shall be present that was made by the first, it is remarkable how seldom the heart-disturbance of

[1] See case mentioned in Appendix, where a loud mitral murmur was distinctly intermittent.

chorea is carried on into adult life. Not only are choreic adults commonly free from heart-murmur, but it is a quite rare experience to find secondary heart-changes, hypertrophy and dilatation, traceable to valvular disease having its origin in past chorea. It must be added that the cardiac disturbance (unless, indeed, it be of rheumatic origin, which is a separate thing altogether) is almost always a sign that must be *sought* for; there are no general symptoms to indicate it, such as distressing palpitation, or dyspnœa. It is not wonderful, therefore, that until the stethoscope came into use it should have been unsuspected.

Endocarditis, then, belongs to chorea as such, apart altogether from the rheumatic origin of the latter. Of fifty-seven cases of chorea with heart-disturbance, I find rheumatism in the history of but six; while, separating rheumatic chorea from non-rheumatic, there is not a much larger proportion of valvular defect in the one class than in the other.

Whether or not the irregularity of action, which is the earliest symptom of heart-disturbance in chorea, and that to which murmur succeeds, is itself the cause of fibrinous deposit, as Dr. Dickin-

son suggests; or whether, as seems possible from its origin and duration, a real endocarditis is set up in these young hearts owing to the irregular working and unequal strain of the valvular apparatus,—whatever explanation we adopt, this at least is certain: that the cardiac symptoms are to be taken along with the muscular as proceeding from a common cause. The *place* of heart-disturbance amongst the phenomena of chorea is now determined, and any exposition of its pathology based upon the hypothesis that endocarditis or heart-defect of any kind precedes the muscular disturbance or renders its occurrence more probable must now be abandoned as violating clinical facts.

To return to the voluntary muscles, it is to be noticed that at all times of life, except the earliest and the most advanced, mental emotion is apt to give rise both to the disordered movements of chorea, and to loss of movement also. It is not easy with grown subjects to foretell the consequence of such an impression, except that it will always find muscular expression somehow. I had lately under observation a man of forty-four, who, after being attacked by ruffians, was found to

stammer in his speech and move his limbs restlessly when addressed, the right arm having become powerless. Similarly, Dr. Todd tells of a man of sixty, who, upon the mere irritation of argument, after displaying strong excitement, became temporarily hemiplegic, the loss of his temper involving the loss of his limbs.

It must be freely admitted that the chorea of childhood is less closely associated with mental shock than is the much rarer chorea of puberty and adult life. It is an affection of movement alone. The chorea induced by some grave terror is all one with that which follows rheumatism. At the outset of the affection, be its cause what it may, it is curious to observe how readily the patients are amused, their sound uninterrupted sleep, good appetite, and general contentment.

There are, indeed, certain facts of disease which help to explain this issue of mental impression in purely motor disorder—facts, I mean, which exhibit muscular movement as the exact correlative or complement of mental emotion, making the two freely interchangeable as joint yet varying factors in the individual life. I will mention but one. A

girl of eleven was lately under my care in this hospital, afflicted with what might be called 'falling sickness.' On hearing unexpectedly any loud noise, she would start so violently as to lose her balance and fall to the ground, and in this way sometimes got badly bruised. It so happened, however, that the noise would sometimes fail to produce its usual effect, so that, instead of falling, the child would merely start. On these occasions, although escaping the shock and hurt of fall, the girl would always shed tears. The emotion, which was entirely absent when the shock was violent and the fall severe, was always expressed when the start was moderate and the fall saved.

To what conclusions do such facts point? Surely to this: that the pathology of an affection like chorea is to be sought in the natural endowments of the individual; that it comes to be a child's disease because those elements out of which it is evolved are especially prominent in early life; that childhood not only *predisposes* to chorea, but has also the material out of which it is made. Such a doctrine, I am aware, will find little favour with those who decline to recognise pathology

apart from morbid anatomy, and regard functional disease as a phantom already fading before the light of science. Ordinary chorea hardly comes within the reach of these observers; they are compelled to judge of it post-mortem and from its rare exceptions. On the contrary, the hypothesis to which I would now ask your attention seeks its illustrations from the every-day incidents of the disorder; it professes to give an account of its whole history, and to find support, not from one or two remarkable instances, but from every case of chorea that has ever happened.

The facts to which I allude are, indeed, lost sight of in their very familiarity. Regarding the muscular system as subserving many uses in locomotion —handling, speaking, and the like—we do not sufficiently consider how in all these uses, and beyond them all, the voluntary muscles are the visible expression of the mind. It is no adequate representation of this relationship which speaks of the muscular system as the *instrument* of the will. It is its colleague, and often its master. Consider in what intimate respects muscular movement and posture express the man; how in all his moods

and chance attitudes, in repose as well as in action, they never cease to express him. Not to speak as yet of emotion, there are the influences of education and culture and habit and inheritance, all conspiring insensibly to mould the man, so that, apart from his will, and often in spite of his will, his muscular carriage becomes the index of his mind, and is, in fact, a part of it. This principle is so imperative as to be visible through all the accidents of awkwardness or physical weakness; it is so universal, that although, roughly speaking, the mode of progression is always the same, it requires but slight knowledge to recognise everyone at a distance by his gait, and no long acquaintance to read the mind from the gestures.[1]

Now, this muscular deportment becomes distinctive in strict harmony with the mental growth. Uncertain and unstable in childhood, it tends, as life goes on, to become fixed and indelible, and indeed automatic. When mental and bodily development are completed, the man, so to speak,

> Among the honest shoulders of the crowd,
> Read rascal in the motions of his back,
> And scoundrel in the supple-sliding knee.
>
> Tennyson's *Sea Dreams*.

settles to his stride, and the muscular carriage becomes what, apart from accident, it is likely to remain until the infirmity of age makes the body tremulous and slack to obey. This early variableness and later fixity of muscular habit is well illustrated in the several employments of the hand.[1]

[1] It is not too much to say that the human hand, with the arm that serves it, is so intricately expressive that from its ordinary movements, apart from its owner, and without any guidance from size or texture, the age may be approximately known. I remember years ago seeing General Tom Thumb at the Crystal Palace from one of the galleries. At this distance, from his size and dress, he appeared like a child of six or seven. Yet this impression was immediately rectified by a very slight movement of his in raising his hand to scratch his chin with his forefinger. It was apparent from that trifling act that he was not a child, or a youth, but a man.

And along with this distinction of age, which is beyond all power of disguise, we have to regard the hand (and in a lower degree other muscles also) as being more than a mere instrument of the will. Witness its gradual acquisition of dexterity, its endless faculty of improvement, and the fidelity with which it soon learns to execute, as it were of itself, without the aid of attention, a great variety of complicated acts, never confusing one with the other, or altering the manner of any from being engaged in acquiring some fresh use. What the hand stores up is seen in the ease with which the painter or the musician exhibits his skill, and the certainty with which the fingers may be trusted to fall into their place in games and tricks of legerdemain. Tracing back the process of manual education, it is not wonderful if so sensitive and intelligent a member, when overtaxed or tired out in the course of its training, should betray fatigue or strain by something more than mere failure. In other words, the fact that in over-worked or over-schooled children chorea so often begins in the hand may be due to the pre-eminence

Until nearly thirty, few men have finally resolved how to sign their own names. After that age the handwriting changes but little till it becomes shaky with years. Like other muscular performances, it is only in a measure voluntary in middle age; it is with pain and effort and ill success that we write a feigned hand,—so soon as attention is removed the fingers slip back into their old habit. It is the same with bodily carriage. We can but disguise ourselves a little and for a little while. There is always a tendency to swing back. The body, like the mind, though moved by many agencies, has one even tenor to which it will always revert.

With the strict preservation of individual habit there concurs endless variability between man and man. This, again, is best shown in those muscles which are the highest as being most concerned in intellectual service. No two pairs of hands will execute the same task in the same manner; yet there is no single hand engaged repeatedly in any

of that part in mental respects, and the fact that restlessness and want of muscular consensus is its natural expression of over-strain. The choreic hand of the child is thus analogous (it is far, of course, from being *similar*) to the shaking hand of the old man. Both are manifestations of muscular fatigue. (See Appendix, p. 142.)

use but will fall into the habit of moving on every occasion precisely in the same way.

By a limitation obviously too narrow, expression is supposed to concern the face. It is there, no doubt, after the period of childhood, that the fineness of muscular adjustment to mental mood is best seen; partly because the muscles to be used are free from other employment, and partly because we are always conscious that the face is the index whence all men will seek to discover the actual working of our minds. But the muscles, considered as one company, are *all* expressive both of our present temper and of our habitual composure or mobility, although each group varies from the rest in its readiness of response. *Every department of the muscular system has thus its own measure of stability, and for its due order requires a corresponding force of control.* The muscles of readiest response are also those of ordinary expression. In ordinary converse the face-muscles are continually being moved over and above the movements actually requisite for articulation. In this wide range of movement (which is so varied as to defy anatomical analysis), supplemented by movements of the head

and shoulders, and the occasional convulsion which is called laughter, the sentiments of our ordinary routine life find sufficient expression. But as the individual is moved or agitated in mental respects, so, precisely, is he moved or agitated in bodily respects. The area of movement is continually widening. Thus, if conversation be converted into declamation, the arms are moved and the body raised on tip-toe; and if excitement be still further increased, muscular movement becomes general, the several groups of muscles yielding successively in the order of their stability. There are emotions of every variety of strength; and, as these muster, the man yields one point after another until all are surrendered, from the conceit that just wrinkles the face, to the strong passion that deforms the whole frame. In our artificial civilised life, subject to satiety rather than surprise, the recurring round of monotonous duty is seldom broken by emotion of this violence. When it is so, custom and education are alike opposed to any open display. Tears must be suppressed, and laughter almost without noise. Emotion will find expression nevertheless; yet, owing to the violent restraint which is put upon it,

it is distorted from the method of nature. With most men sudden grief or surprise or joy expends itself, not in increased muscular movement as nature would have it, but by convulsion of the face. The natural motor-response is converted into a hideous spasm.

But while these phenomena express generally the conduct of the muscular system considered as an exponent and correlative of the mind, they are subject to important modifications at different periods of life. In childhood muscular movement is active and incessant, while the imperfect impressions that crowd into the mind are evidenced less by the face than by movement of the whole body. Children, more obviously than men, habitually *express themselves all over.* They know no reason for disguise, and have no respect for conventional uses. In spite of discipline and correction, the child still remains a restless individual, without the strength to be still, never dwelling upon an attitude, with a constant desire for movement, but little method or purpose in moving.

In the life of a single individual from infancy to old age the display of emotion (by which I mean

not strong passion only, but all the sentiments that animate mankind) changes in method and seat and measure in exact correspondence with mental development and the ever-growing force of habit and association. The infant, unable to direct its movements, makes aimless springs and kicks and grimacing—a language as little coherent as its thoughts. Its chief response to material irritation is by way of spasm. Enlarging presently its field of observation and experience, the infant becomes a restless, impressionable child, moving its limbs much more than it uses them, with no defined purpose, and expressing such mind as it has almost entirely by that method. It has learnt to move imperfectly, but has yet to learn to be still. Next comes the reign of emotion. New passions now find expression in various perturbations of the mind, evidenced by tears and sighs and all the apparatus of hysteria, with less of muscular movement and more of muscular spasm. Mental impressions are now first clearly apprehended and intelligently expressed by words and appropriate gestures. To this succeeds the contemplative sedateness of middle life, with its habitual attitudes of body and fixed expression of

face. Muscular stability is now at the highest. The control of the mind over the body is complete except for the tyranny of habit. At the last comes old age, when mental emotion is hardly expressed and but feebly felt, and such movement as occurs is but the trembling of tired-out muscles.

In these transitions allowance must, of course, be made for differences of sex and nation, and individual temperament. One will prolong his childhood, another will anticipate old age. Nevertheless, the great epochs of life preserve their distinctive characters, and the same quality of change is to be seen in every human being. As mental impressions get more and more clearly apprehended, so more and more do they fail to excite movement, and find proper expression in language and muscular attitude. The nature of the response—whether it be spasm, or over-movement, or relaxation of muscle —corresponds generally with the period of life.

It is, as I believe and have yet to show, a legitimate application of what has been said at tedious length to regard chorea as an affection of function, as hysteria is. It exhibits certain of the characteristics of childhood in unnatural exaggeration,

and brings forward prominently what is always visible in the background. Without seeking now to justify the term 'functional disease,' I can perceive in chorea an exaltation or exuberance in the exercise of those functions which, in early life, are at the best turbulent and prone to disorder. I see its beginnings in every child, and more than its beginnings in every child that I know well or have met in trying circumstances. The hypothesis of embolism, or thrombosis, or sub-acute inflammation (even supposing that any of these sufficed to account for the facts of chorea, or could be shown to be actually present along with it), would still be unnecessary. To justify and illustrate this view will be the object of my next lecture.

LECTURE III.

LAWS OF ORIGIN AND DEVELOPMENT.

CHOREA COMPARED WITH EMOTIONAL OVER-MOVEMENT — ABSENCE OF MENTAL DISTURBANCE—LONG DURATION—LINGERING CHOREA OF EARLY CHILDHOOD — SEVERITY OF THE DISEASE AT PUBERTY—INCURABLE CHOREA OF ADULTS—THE ORDER OF MUSCULAR STABILITY — IMPLICATION OF THE HEART IN CHILDHOOD.

GENTLEMEN,—In endeavouring to maintain that hypothesis of chorea which was put forward at the end of my last lecture—the hypothesis, namely, which seeks to construct a pathology for the affection out of elements already existing in the individuals who become the subjects of it—I shall address myself to these three topics. First, to point out the intimate resemblance between chorea and such disorders as we are all agreed to call functional; secondly, to consider some features of chorea in which it may be thought to differ from ordinary functional disturbance; and, thirdly, to show, by reference to those essential characters of

chorea which have been already discussed, that the proposed hypothesis *works*—that things are as they should be, supposing the theory to be true.

I need not dwell further upon the fact that chorea belongs especially to the restless age and the emotional sex. It will be conceded, perhaps, on all hands that the characteristics of women and children obviously predispose them to suffer in this way rather than men. It is the immediate *cause* of the disorder, you will say, that is to be made out; its mode of distribution is sufficiently plain. Passing this, therefore, I would repeat what I said at the beginning—viz. that the affection may be invoked almost at pleasure, a very slight impression from without sufficing to produce *temporarily* in a shy child that form of restlessness which is in fact chorea. And not only so, but, as we ascend in age and encounter greater mental and muscular stability, *the same kind* of impression, only of greater severity, will still produce a similar result. Similar, yet not the same; it is no longer, as with the child, a general movement of the limbs, but tends to limit itself to the face and head and arms, these being, as we have seen, the muscles of readiest response.

Now, this emotional restlessness (for I would not seem to anticipate your assent by calling it temporary chorea) is not to be seen in perfection amongst grown people, except under extraordinary circumstances; yet it is often accurately counterfeited for our amusement. Chorea is to be seen on the stage, just as hysteria is; but the names do not suggest themselves, because the display of emotion is in just proportion to the cause which excites it. When young women of a humble class are receiving with ill-concealed satisfaction the addresses of their lovers, their emotion overflows in chorea. Audrey is choreic with Touchstone. Even less inducement will produce a limited limb-movement which is essentially of the same kind. Among young people of the educated classes, especially young girls, there is the movement of the hand in animated conversation, fumbling a chain or a locket. The action is not unbecoming, and it seems ungracious to speak of it in this relation; yet it is in fact chorea, purposeless so far as muscular movement is concerned, increasing and decreasing with the movement of the mind—a purely mental expression, rising sometimes to a very grave disorder.

Observe, too, that this movement is at first one-sided. Although independent of embolism or thrombosis, it is *hemi-chorea*. Yet, if the conversation become warm, it will spread to the other side. A male habit of a kindred kind is the crumbling of one's bread at dinner, unilateral as a rule, yet becoming two-sided on occasion—as with Sydney Smith when dining next the Archbishop of Canterbury.

Or, take again the orator, and observe that while his discourse moves him, so in its turn the muscular movement stimulates the mind the more. It is commonly known and taught by elocutionists that the speaker may keep his words within due moderation by resolving beforehand to keep his hands quiet, clasped together or resting on the desk before him. The mind is so fettered to the body that the command of either ensures the due order of both. It is quite true that the gestures of the orator may be so orderly, graceful, and apposite as to resemble chorea only as being a muscular over-movement. This is so because declamation has been taught and studied. The arms, which *must* move somehow, are trained to move in a particular

fashion. But see the same speaker with his arms behind him. Hands thus concealed, or thought to be concealed, are commonly affected by a true chorea, which differs in no respect that I could discover in watching them from the chorea of childhood.

The influence of the mind over muscular expression is seen further when muscular acts have to be executed under observation, as performing experiments or tricks before an audience, where a certain assurance of success is necessary, which is by no means secured by knowing that the experiment or trick can be done in private with perfect ease. The same sort of experience is familiar to many as applicable to articulation. It is expressed by various metaphors: 'The tongue sticks to the mouth;' 'The man is afraid of the sound of his own voice.' It is to be remarked here how the inward misgiving is itself the cause of the failure; how, too, so soon as the hand or the voice begins to fail, ever so little, it fails altogether. The muscular disorder, once started, is certain to spread; it is never barren or unproductive. The fluent speaker falters, and soon breaks down; the accomplished billiard-

player misses a stroke or two, and thereupon 'loses confidence' and with it his accustomed dexterity, for the rest of the game. The over-movement of growing-up girls at what is called 'the awkward age' is a further instance in point. The emotion produced by being observed is ever ready to express itself in ungainly attitudes. In spite of governess and dancing-master, and with no muscular defect, there is a want of repose of the body corresponding with that of the mind. Again, the intimate union of mind and muscle may be seen in the more or less choreic action of the latter when the movements of the two are not in full accord. There is the smile where no joy is felt which is often painfully choreic. There is even the tone of pretended sympathy or congratulation which often betrays itself in the same way.

Now, this emotional over-movement finds its chief subjects and fullest illustration in children. As general muscular movement is their main expression of mind, so general muscular disorder is their main expression of mental emotion. In the composed stability of later life, however, it is no longer disordered *movement* that we see, but dis-

ordered muscular *attitude*; some fixed expression or posture of face or limbs mentally produced, and which very soon becomes impressed and indelible. The sexual preference now no longer prevails, or rather it is reversed. Men more than women (probably from greater mental engrossment and less regard for appearance) easily acquire a particular position of certain muscles; these become habitually contracted or relaxed, so that the individual seems to be always frowning or smiling or grimacing. By a slight modification of the same law, he may fall into a monotonous and soon unconscious practice of muscular act; humming as he walks, or carrying the arm or the head in a particular fashion. Thus disordered movement, which is never very far from youth, is replaced by settled grimace, which is never very far from middle age. True to the natural habit of the two periods, movement is disordered in the one, attitude deformed in the other.[1]

[1] The custom of every-day intercourse and the very perfect control of the face and limbs which distinguishes 'good society,' lead to a sort of belief that the outward expression of emotion by muscular over-movement, or spasm, or tremor, or paralysis, is in part voluntary—a mere recognition on our part that we are adequately moved by

If the habit of the child were a habit of stillness, moving its limbs only when and so far as it

some external influence. Similarly, certain muscular habits of young persons are held to be far from involuntary—are known, indeed, sometimes to be carefully *affected* for a purpose. This view of the matter, however, concerns a highly artificial state of society, where strong emotion is rare, and the correct method of exhibiting feeling is taught and practised in the schoolroom. Nevertheless, however we may forget it, the speechlessness and general paralysis of terror, the trembling of many kinds of emotion, and the loss of muscular consensus under the eyes of another, are as true and real and beyond our resistance as are the same phenomena when amongst the symptoms of apoplexy or of ague, or of muscular ataxy.

A newspaper correspondent at Plevna lately was an eye-witness of an assault on one of the Turkish redoubts, and, with the aid of a field-glass, wrote down the incidents of the fighting as they happened. At a critical juncture his arm became so tremulous from excitement that he could no longer hold the glass. Still watching what went on, and recording it, he had henceforth, to his great loss and annoyance, to trust his unaided sight, so severe and genuine a spasm having possession of the limbs he was in the habit of accounting voluntary muscles.

In the same way the *habits* of muscles, although carefully put on in youth, and sometimes after youth, as in themselves becoming, or from the desire to be like some one else, are as absolutely indelible as any other deformity. No one who has reached middle age will be disposed to deny this. Yet the harmlessness of these muscular habits, the age at which they are most prominent, and the tacit admission of their incurableness, concur to keep them from mention and exact description.

The minute fidelity of Boswell did not omit this feature from the portrait of Dr. Johnson : 'He had another peculiarity of which none of his friends ever ventured to ask an explanation. It appeared to me some superstitious habit which he had contracted early, and from which he had never called upon his reason to disentangle him. This was his anxious care to go in or out at a door

used them, any shock that suspended their proper exercise might stop their action altogether, as it, in fact, does with the adult, who, upon mental excitement, as we have seen, gets not chorea, but temporary paralysis. With the existence of childish mobility, however, a similar shock does not abolish movement, but only disturbs such order as it had.

I find, then, a law in operation among the people who become the victims of chorea which would almost suggest to my mind that liability. I find them habitually restless and disturbed by slight causes in a particular way. I observe that their over-movement is purposeless in itself, easily

or passage by a certain number of steps from a certain point. I have upon innumerable occasions observed him suddenly stop, and then seem to count his steps with a deep earnestness; and when he had neglected or gone wrong in this sort of magical movement, I have seen him go back again, put himself in a proper posture to begin the ceremony, and, having gone through it, break from his abstraction, walk briskly on, and join his companion.' With much more to the same effect. (*Life of Johnson*, Croker's Edition, ii. 279.)

To appreciate the *force* of habit, we are to consider its inconvenience, and the constant effort that is being made to resist it. Hesitating to accept the correspondent's trembling as an actual tremor, or Dr. Johnson's conduct at doorways as a real and incurable affection, we fail to apply the principle of which they are illustrations, or to recognise the operation of the same law in many kindred phenomena which are commonly included within the region of disease.

aggravated, affecting the body rather than the face, and the arms more than the legs. I notice that upon excitement this over-movement spreads from limb to limb in a certain order, and that it eventually overflows in mental emotion. Under proper restraint (which those that have charge of children seem careful to exercise), I perceive that this restless movement is both the cause and the consequence of pleasurable sensation. Nevertheless, from observing how easily it grows, how the weakest yield to it most, and how it increases upon indulgence, I can well foresee that upon any extra strain it might readily issue in a distressing restlessness altogether beyond control.

It is true that the diseases we evolve out of anterior considerations are not remarkable for their accuracy to nature, and that an inevitable proneness to indulge in this habit has disfigured medicine in all ages. Nevertheless, supposing our acquaintance with men and women to be what it is, and that we had been but recently introduced to little children so as to have learnt something of their language and customs and modes of thought, but nothing of their diseases, I think we might

predict that some affection like chorea should be amongst the products of their over-activity, keen perception, and imperfect self-control.

But, it will be said, admitting the phenomena of chorea to be in some respects analogous with those to be seen in emotion (for if this much be not conceded the whole contention fails), yet still the difference is wide between the temporary choreic movement induced by shyness and the persistent agitation of chorea. We have, therefore, in the second place, to consider those features of the disorder in which it may seem to differ from any mere functional derangement.

The most obvious objections to the view I would support are these three: 1. Chorea, as a rule, does not exhibit mental emotion, be its cause what it may. 2. Chorea both persists and increases; it does not subside, like the emotional over-movement with which you compare it, so soon as its cause is withdrawn. 3. It is not a disorder of voluntary muscle only, but often of the heart, and sometimes of other organs also.

Now, it must be admitted that the emotional exaltation which is at the origin of fright-chorea

is not continued throughout. The muscular disturbance not only outlasts the mental, but often increases after this latter has disappeared. Yet this is true to the pattern of ordinary emotion in childhood. Habitually, muscular action of some kind or other comes to the relief—that is, to the replacement—of the mental agitation. Either over-movement of limb or actual spasm (the powerful convulsion of sobbing, for instance) disperses the fit of joy or of sorrow. We have here a veritable transmutation which may be complete or partial. With little children it is complete, but with growth the mental element gets less and less transformed. Older children are apt to have hysteria along with chorea, while the chorea of young women is sometimes eventually lost sight of in hysteria pure and simple. Precisely the same thing occurs in the proper physiological response to mental impression. Between the strong man and the weak child there are, as we have seen, all varieties in the nature of this response. Yet *there is always muscular expression of some kind*, whether by attitude or movement. There is the relaxed attitude of despair, while the mind dwells upon calamity; the sorrow,

too deep for tears, finding no outlet and no relief; and there is the passionate outburst of sobs and wringing of the hands in which the child's grief is wholly expended.

But it is asked, Why should emotion thus transmuted into movement continue so long, habitually growing worse, and sometimes becoming permanent? It may be answered that muscular disorder once established (and, still more, *once observed upon*) is sure to abide and spread; it is its nature so to do. Differently, however, with different persons. In the case of men (or of most men), the disturbance is at once met by the combined force of personal will and old-established habit. The individual draws more largely than usual upon his self-control; he recovers himself by an effort, and is only observed to be more constrained and careful than usual in attitude or more mobile in feature or temperament.[1] Men, it is

[1] It was several times remarked during the Franco-Prussian war that men after undergoing exceptional danger without bodily injury, would be more than usually alive to jokes, laughing immoderately on slight occasion. There are many similar instances of emotion restrained as unseemly, yet taking advantage of some small opportunity to escape under a disguise.

true, are not made choreic except temporarily and upon the first surprise. Nevertheless, strong mental shock (no stronger, however, comparatively, than that to which the young child in its feebleness and half knowledge is always exposed) produces an effect which is not transitory, but indefinitely prolonged. There is little muscular agitation, truly, but there is a change in muscular carriage and attitude. The whole frame becomes slower of response, the head is bowed; it is noticed that the man is not the same, that he has suddenly aged. Yet with this obvious change the individual is still recognisable owing to the strength of old habit. The muscular customs of years are not easily obliterated; they have become in great measure automatic and readily fall back into their old swing. The animating spirit is lowered, but the same method remains.

The case of the little child is quite different. There is here neither self-command nor motive for concealment, while the methods of ordered movement, as yet but partially learned, have gained no stability[1] and require strict attention for their

[1] The word 'stability' applies here in the precise sense which it

proper performance. We have to do with an unreasoning individual whose common mode of expression is by limb-movement, which its utmost attention is insufficient to restrain. Add now some mental disturbance sufficient only to divert that attention, and the result can hardly be other than that we see. Movement is increased; the proper co-ordination of movement is lessened; lessened, that is, absolutely, because the necessary attention is withdrawn, but lessened still more in appearance because the sum of muscular movement is increased.[1] And observe, that the very first appearance of muscular disorder is enough to ensure its continuance. Such imperfect control as the child possesses is now relaxed. That it will at once summon up strength to quell the disturbance, no

serves in mechanics. The muscular equilibrium of the adult is 'stable,' tending on disturbance to revert to its place; that of young children is 'unstable,' having the contrary tendency.

[1] It is necessary to distinguish between the infantile movement which education restrains and the purposive movement which education and experience develop. Movement is due now to defect of intelligence and now to its exercise, while the capacity for stillness grows *pari passu* with the acquisition of use. Upon mental shock the child is thrown back to its early and untrained condition, but with the modification arising from still lingering memory of the old order.

one that knows a child's nature will suppose. On the contrary, the *sight* of the disorder, its being observed upon and put to penalties, and the whole mode of life altered in consequence of it, can hardly fail to deepen the mental impression and extend its consequences.

But, besides this, there is that in the disorder itself which tends to propagate further disorder. I have alluded already to instances of chorea aggravated by derision or reprimand. But aggravation comes from within as well as from without. The affected limbs, in their failure to execute the purposes of the will, become, so to speak (and it is no inappropriate figure which expresses motor acts in the terms of mind,—common language bears continual witness to it), *demoralised*.[1] Just as we find that the assurance of success is required for any ordinary muscular performance over and above the necessary muscular ability, so the expect-

[1] Thus 'touched,' 'moved,' 'shaken,' and 'upset,' are understood to refer to mind or body, according to the context. There are other words, however, which carry their own connotation so soon as the subject is known. Such a word is 'tickled,' which is understood to refer to a sensation producing muscular movement where used of a child, and to a feeling of inward amusement when used of an adult.

ation of failure is sufficient to ensure failure, though the muscles themselves are not at fault. Everyone must have noticed that the elder children grow irritable under the continual disappointments of chorea ; they must have noticed as well, not only that such children are most composed when unobserved, but that they will do easily many things of themselves which they cannot do under command. The want of co-ordination is not of the kind we see in ataxy. It is very variable with circumstances, and in great degree mental. In some cases there is no want of co-ordination at all.[1]

[1] It has been observed (amongst others by Dr. Gowers, in a paper read at the British Medical Association, but of which only the abstract has as yet been published) that the inco-ordination of voluntary movement varies independently of the spontaneous spasmodic movements, the former being sometimes great where the latter is slight, while the relation between the two at different periods of the same attack is not constant. Dr. Gowers is led to conclude, from this independent variation of the two elements, that 'they depend on a morbid condition of distinct and perhaps separate regions.'

The term 'spontaneous spasm' in the above quotation seems hardly admissible. The word 'spontaneous' is of most equivocal signification always ; at the same time actual spasm is, as I have said, very little applicable to the ordinary movements of chorea. Again, inco-ordination recalls the disorder of movement which characterises 'ataxy,' and which is seldom seen in the same degree in chorea, and never, as I believe, except as *its consequence.* The word is objectionable as seeming to signify a precise condition of

It remains, however, in the third place, to show, by reference to the essential characters of chorea,

absolute loss, and not (as is the fact so far as chorea is concerned) the faulty execution, more or less, of complex muscular movements. If we exclude 'spontaneous' as vague and difficult, and substitute for 'inco-ordination' 'faulty adaptation of muscles in their conjoint acts,' or 'want of muscular consensus,' we still get what I suppose to be meant, viz. that the child's fidgetiness (or, if you will, spasm) is not necessarily in correspondence with its ability to execute muscular tasks. Everyone will agree that this is true.

This ill response of muscles to each other I have maintained to be in its origin due in part to mental causes. It is, I believe, of the same kind as (although it surpasses in degree) the awkward performance by nervous persons of all complicated acts which they are bidden to do, and which they are watched in doing. How far this 'inco-ordination' prevails as a temporary and occasional phenomenon may be seen in the signing of names on set occasions, as in marriage registers, or the volume in which new members of the College of Physicians publicly sign their names on admission. Similarly the faulty motor adjustments of chorea are most marked when the children are under observation, and soon the experience of failure and the habit of doing things wrong helps on the first disorder. It is no true test of the degree of this motor disability to *bid* the patient perform certain acts, as touching his nose or writing his name. It is as fallacious as to judge of the strength and power of modulation of a man's voice by bidding him address an audience.

But 'the inco-ordination,' says Dr. Gowers, 'is distinct from mere inability of the will to still the spontaneous spasm.' Undoubtedly it is. Inability to restrain movement (of which we have numerous examples outside chorea) depends upon habitual defect of self-control, which, nevertheless, the patient can summon up for a while by a strong effort, and is even assisted in so doing by the command of another. Even in bad chorea the child can thus be made still for a moment or so. But the ill adaptability of the muscles in performing tasks is never so assisted. The more they are chid and bidden the worse they work. The muscles will be the easier

that the hypothesis which has been suggested *works*. If the whole tenor of chorea is not in harmony with its asserted origin, the theory must be abandoned, for I would not seek to establish it upon the partial light of selected cases. I venture to think that the view here propounded receives a large measure of sanction from this appeal to facts, and may claim acceptance on its own merits as satisfying the conditions of the problem.

quieted by a child's own anxious *effort* to obey ; yet this same anxiety will not assist muscular *acts*, but rather tends to derange them the more.

'The independent variation of the two elements' suggests to Dr. Gowers 'that they depend on a morbid condition of distinct and perhaps separate regions.' It will suggest to others the similar independence of the same elements when as yet they are not recognised as morbid. The muscular consensus or co-ordination in complicated acts varies inversely with self-consciousness ; muscular stillness varies directly with self-control. There are many individuals, not chargeable with chorea, yet restless and without repose, whose muscles at once fall into order when busied in some favourite pursuit ; there are others, reposeful and free from 'spontaneous spasm,' who will yet exhibit distressing want of 'co-ordination' when some muscular performance is expected of them.

These two 'independent elements,' when present in a certain degree of prominence, may well be called morbid ; they may depend, as Dr. Gowers supposes, on distinct and separate regions of disease ; the nature of this disease may be 'an unstable condition of grey matter.' I am in no position to dispute these conjectures. I only question whether the terms of the explanation are the very best to bring home to plain minds the actual significance and relationships of chorea.

That the chorea of young children should be both common and tedious, yet, as regards the future, comparatively unimportant; that it should become more rare, yet more intractable, at puberty, and in later life sometimes quite incurable; that, at the same time, successive attacks occurring during the childhood of the same individual should be of decreasing severity; that the face-muscles should often be affected alone; that they should always be affected with the adult, but sometimes exempt with the child; that the limbs should be attacked in a particular order, and the same limbs in successive attacks; that the mind should be sometimes implicated and sometimes not; that the same cause which gives chorea to the child should give hysteria to the girl and palsy to the man;—all these features of the disease seem easily explicable upon this simple showing, and upon no other as yet advanced.

What has been already said may be deemed sufficient to justify this statement in part; to justify it altogether will need some amplification.

Observe, first, that while the affection is spreading, or tending to spread, as has been shown,

out of material of its own providing, the newly imported habit of disorder is gradually effacing the old habit of order, and impressing its own characters instead. Hence it is that in young children with no very severe chorea, but whose habits of purposive movement are but feebly and partially fixed, the new habits soon become stronger than the old have ever been. It is very difficult in such instances to summon up the material out of which amendment is to be built up. These cases are tedious out of proportion to their severity. They make no progress. Yet, unlike some adult patients, they recover at last almost certainly. They have but to wait for their cure until the mind is able to make effort on behalf of the body.

It is different with the chorea of girls at the time of puberty. More rare, and more difficult to excite than the other, it is usually severe, and sometimes even fatal. In these subjects, with the setting up of a new function the mental condition is for a while on the side of disorder. The violence of the storm is shown both in muscular movement and mental emotion. Yet here, too, when the new life is established, an improvement of will-power

and mental stability will gradually provide a cure. Such chorea, though it is sometimes fatal, is never a permanent disorder.

In grown-up persons, on the other hand, when chorea has once obtained a lodgment, and dispossessed long-settled muscular movements,—an event rare and difficult, as would be supposed,—the new habit is apt to acquire all the force of the old. Adult chorea, which is usually partial, and oftenest in the face, soon comes to share the character of the other muscular habits. Like the trick of grimacing at the same age, it becomes fixed and indelible. There is here no reinforcement to be looked for in the growing capacity of self-control. This form of chorea, therefore, is not uncommonly quite incurable.

From this same point of view we are able to reconcile the apparent contradiction that, while adult chorea is often permanent, successive attacks of the affection during childhood are continually less severe. In the child's case the same chorea, repeatedly called up, has to encounter on each occasion a greater resistance on the part of the ever-growing will. In the man's case the appear-

ance of the disorder denotes a victory over all the power of resistance which established habit and matured will could offer. The mere fact of possession is some security for permanence of tenure.

Again, the order in which the muscles are successively affected in chorea accords with its functional relations. It is misleading to exalt one-sided chorea into prominence. The affection does not travel *along* the body, but *across* it. The hands and arms of children are affected first, because these are the limbs chiefly concerned in expression and the higher intellectual uses, and most responsive to mental impressions. The lower limbs, less exalted in function, are concerned in movements which, once learnt, soon become easy and automatic. The child will run and jump with ease and agility, while its arms and fingers are still occupied in difficult learning. In chorea, except with very young children, the legs suffer late and recover early, and usually the two together. Removed from the active and laborious control of the mind, they are slow to catch the disorder, and ready at the first suggestion to resume their orderly automatic movement.

The order of attack is somewhat altered in older children and grown girls, yet still in illustration of the same principle. With the growth of intelligence and self-consciousness, the muscles of the face become peculiarly sensitive and difficult of control. The face, therefore—but little affected, it may be, in young children—becomes the special and sometimes the sole seat of chorea in the elder girls and young women. The chorea of pregnancy always affects the face. Strictly speaking, there are very few hysterical women who are not also choreic thus far, nor is there a human countenance with a mind behind it that the affection does not reach sometimes.

It is for this reason that chorea is so often confined to the face throughout. Parents who have experience of the affection so far as to know that it commonly spreads from small beginnings, will often fear that facial twitching will lead to general motor disturbance. Their alarm is groundless. The power necessary to command the face is so far higher in degree than that required for the other muscles that there occurs, so to speak, a gap between the two. The one task is impossible,

while the other is easy. 'Nervous twitching' beginning in the face is little likely to spread. The weakest part has succumbed, but the parts beyond are so far stronger that they are hardly threatened in consequence. On the contrary, chorea of the legs is almost certain to involve the upper limbs also.

Governed by the same law of varying stability, it is not a matter of indifference, I suppose, whether the right or the left arm is first affected. I have as yet no sufficient statistics on the subject, nor is it easy to state in which way the principle would be vindicated. A fair comparison would require subjects of the same age. With young children right and left are all one, while with those that are older it is not unreasonable to suppose that the asserted frequency of left- over right-handed chorea may be due to the fact that the left arm and hand are less educated, and therefore less stable, than the right. On the other side it may be said that the right hand has to perform the more complicated movements and is more *tried* than the left. It is to be remembered, moreover, that left-handed chorea is less likely to be at once discovered, both

because the left hand is less used, and that awkwardness and failure are instinctively associated with all that it does.[1]

It has often been remarked that in successive attacks of chorea it is the same side that suffers repeatedly, whether right or left. This is held for an argument in favour of some central origin of the affection. Not to dwell further on the exceptional character of one-sided chorea, it is in accordance with our everyday experience that muscular disorder is recalled exactly in its first shape when the circumstances recur. It is no figure to speak of the muscular system as having a memory of its own. It is this memory which causes the soldier always to step off with the left foot; which directs the hand to the face, in moments of reflection, with an unvarying attitude of the thumb and fingers peculiar to the adult; which enables the most intricate music, once learnt, to be fingered easily while the mind is away. The repetition of the same chorea is analogous to this repetition of all muscular acts whatever, good or bad, even those for which there is but infrequent occasion. There

[1] See Appendix on 'The Starting-place of Chorea.'

are persons with no other impediment of speech who will invariably stumble over the same word when met with in a particular connection. I know a clergyman with perfect fluency of speech who will thus falter before two words, not in themselves difficult, occurring annually in a collect of the English Liturgy. It is the same with peculiar attitudes in adults as with chorea in children; only with these latter the muscular instability tends to grow weaker on each repetition as their power of control strengthens. Successive attacks are of decreasing severity until, as it is very aptly expressed, the child 'grows out of them.'

There yet remains the objection that the heart-affection of chorea is without parallel in any functional derangement. I have spoken already of this occasional symptom, and would only repeat that it is the consequence and not the cause of chorea, and that this latter may occur with whatever severity without it. We are left, therefore, to construct its pathology independently. Heart-disease in this connection, be its significance what it may, is in some respects peculiar and *sui generis*. If, on the one hand, it may be insisted that the

heart-disturbance grows sometimes into a real structural disease comparable with that produced by rheumatism, it may be said, on the other, that in its variability, mode of advent, and ultimate subsidence it is analogous rather to those functional heart-affections of half mental origin which arise with commencing puberty and disappear with the completion of youth.

LECTURE IV.

PATHOLOGY OF CHOREA—TREATMENT.

IMPAIRED MUSCULAR CONTROL THE IMMEDIATE CAUSE OF CHOREA—ANATOMICAL LESIONS ITS CONSEQUENCE—ANALOGY OF THE PASSIONS—GENERAL PRINCIPLES OF TREATMENT—THE EMPLOYMENT OF DRUGS—OF RESTRAINT.

GENTLEMEN,—The hypothesis of chorea which has been now proposed, and in a measure vindicated by reference to the special characters of the affection, is still further commended by this: it admits of a common cause being asserted for all chorea alike. It is quite certain that neither anæmia nor rheumatism nor fright can stand, as such, in that relation. And yet the chorea of rheumatism is all one with that of anæmia or of fright. From the common result we are irresistibly led to seek a common cause. The theory of mental impression supplies it.

It has been urged already that if fright is an efficient cause of chorea, other emotions, less obvious

because less easily expressed, but to which childhood is especially liable, will probably be so too. Why should not physical pain be placed in the category? In early childhood it is a new sensation, for during infancy pain is not mentally recognised. That form of pain, especially, which is aggravated by movement, not only arrests the process of muscular education, but deprives the child at the same time of its chief means of expression. It is not surprising, then, that an affection like rheumatism should so disturb muscular control that, when the disused limbs are again set free, they should fail to resume that proper order of movement which the illness had interrupted when only half learnt.[1]

Not only rheumatism, but even trivial localised pain is found to produce chorea. Something similar may be observed in the allied affection, hysteria. There are many women who, by painful effort and watching, succeed for the most part in keeping

[1] Similarly hemiplegia may give occasion for chorea, not directly in virtue of the brain lesion, but indirectly from arresting for awhile the limb-movements and impressing the mind. *Any* sudden nervous shock, indeed, would furnish a cause for chorea of precisely the same kind, mentally considered, as ordinary terror. Thus, partial convulsion is sometimes followed by chorea not only of the limbs that have been convulsed, but of *all* the limbs.

under their over-emotion. But when from any cause, such as pain or mental excitement, this difficult self-control is weakened, emotion gets the mastery. Bodily pain is not the cause of hysteria any more than of chorea, except indirectly as taking away the little obstacle that is in the way of it. The language of common life (which may always be trusted to recognise such phenomena) has not failed to notice the bodily expression of physical suffering. Individuals are said to be 'quite unnerved' by painful injury. No physician, and still more no surgeon, can have overlooked the extra mobility, often the chorea-like movements, of those who, without any direct mental shock, are suffering pain, and especially a new kind of pain.

But you will say, Why, then, does not illness produce chorea more often than it does? The prolonged wasting diseases of childhood, the marked anæmia of splenic enlargement and of renal disease, do not in the least predispose to chorea, while acute disease is conspicuous rather for arresting than causing it. The answer is, that in general illness the whole vitality is lowered together; if the power of control is lessened, the readiness of response is

less too. It is thus the rule of chorea to emerge when the affection that occasions it has some time departed. The exceptions to that rule are instances of local pain—tooth-ache, joint-ache, and the like. These will provoke chorea *at once*; general illness excludes it for the time, but opens a way for it afterwards.

There still remain those numerous examples of chorea occurring, as it were, spontaneously; neither rheumatism, nor pain, nor fright, nor anæmia preceding. Such cases outnumber all the rest; yet they fit in with no particular theory, and are, in a measure, neglected. My hypothesis requires them; for, if the cause of chorea passes undiscovered, so does also the cause of much childish fretfulness and waywardness. Supposing, I say, the theory of mental impression as a cause of chorea to be true, it would need instances of this kind where the precise origin of the disorder was undetermined.

From such considerations as I have laid before you, I am led to adopt the somewhat unpopular belief that chorea is an affection of function depending not upon anything that is added, but upon something which is taken away. Its elements reside

already in the individual, where they are habitually controlled with difficulty, and always ready to break out in riot. The nature of this control is mental, and, while it grows and strengthens with the intellect, is yet distributed in different measure to different individuals. But it is never so firm and impregnable as to be beyond assault—never, indeed, secure against surprise. The loss of this control may be sudden or gradual, partial or complete; and according to the degree of its impairment, so precisely is the measure of disorder. We pass on without any break at all and only an arbitrary line of separation, from that restlessness and instability which is the heritage of every child to the violent jactitation of so-called 'acute' chorea, where the will is altogether useless, and the nervous centres are beginning to suffer and make a response of their own.

The facts of chorea, so regarded, take their place among other nervous phenomena, and form part of that material out of which the whole economy of nervous action and the mechanism of nervous response are to be one day ascertained. When that solution comes, it will probably find expression in other terms than those of structure, and be

recognised, first of all, by other eyes than those of the microscopist.[1]

If, indeed, the phenomena we have been considering are best expressed in the words of Dr. Bastian, as 'due to an enormous down-rush of molecular motion;' or by saying, with Dr. Dowse, that 'the automatic balance of nerve-function is superseded by emotional hypergenetic agency,' it must be gratifying to learn that the facts can be so compendiously stated. But that the vascular theories at present in vogue, whether of general arterial repletion or minute emboli, or of thrombosis, serve in any degree to explain, or are even consistent with, those clinical features of chorea of which we have spoken, I for one would venture to deny. In accepting the guidance of morbid anatomy it is necessary to remember the circumstances in which it is given, and the stage of chorea to which it refers. 'In looking at the nature of the lesions,' says

[1] I would here refer the reader to Mr. Lewes's *Physical Basis of Mind*, which had not appeared when these lectures were given. Had I then read that book, I cannot doubt that the views here expressed of the pathology of chorea would have gained thereby in clearness and precision.

Dr. Dickinson, 'it is not possible but to connect them with those of a large group of nervous disorders.' How, then, it may be asked, can they be adduced in explanation of symptoms which are peculiar to each member of that group? That hyperæmia of the nervous centres (such as Dr. Dickinson has shown to exist), or actual destructive change, should be amongst the *products* of chorea, and that it should produce in its turn results of its own, even if it were not in evidence, would be an almost necessary hypothesis. How otherwise could we explain the remarkable fact that in rare instances chorea is transformed into a violent and ceaseless spasm in which all the characters of the original disorder are lost? Yet while hyperæmia, occurring as secondary to the limb-disturbance and in consequence of it, serves to complete the picture of chorea, it is gratuitous and unintelligible when regarded as its cause.

'The nature and the steps of the morbid process,' says Dr. Dickinson in the paper I have repeatedly quoted, 'hyperæmia, exudation, and its consequences, are open to view, but not so the causes in which the series has taken origin. Arterial repletion

seems mainly concerned in the development of the disease. Why or at what bidding do these vessels thus gorge themselves?' The answer to this question, as Dr. Dickinson intimates, concerns the priority of origin between vascular and nervous changes, and, in this case as in others, is likely to remain undetermined. It is not possible, I conceive, to place in order of time the material changes of chorea any more than of fear or of passion. We speak of one in anger as 'pale,' or 'dumb,' or 'breathless,' just as the disturbance of circulation, or innervation, or respiration is the most striking. Yet all these functions are deranged together, and so nearly simultaneously that no observation can fix the actual starting-point, or, even if it reached it, would be able to recognise that ideal 'irritation' so freely spoken of as preceding the earliest material change. Although almost everyone has a very decided preference, either for the vascular origin of disease or the nervous, yet this preference is arrived at upon considerations beyond the range of pathology, and indicates no less than our adhesion to one or other of two schools of speculative belief.

'No one thinks,' says Dr. Liveing[1] (of whose observations what I have been saying of chorea is no more than the corollary), 'of a condition of hyperæmia or anæmia as a necessary attendant of a fit of sneezing, vomiting, laughter, or terror, or imagines that such hypothesis would assist our comprehension of the nature of these phenomena. We regard them as primarily nervous, and any disturbance of the circulation as an effect of the nervous disorder. In the various passions and emotions,' he continues, 'we have very obvious signs of disturbance both in the general circulation and local distribution of blood. Yet no one points to these incidents as a key to the condition of the nervous centres on which the paroxysms depend.' 'Why,' he asks, 'should it be different in pathology?'

Without seeking, therefore, to determine in the case of chorea those ultimate questions which remain undetermined for all disease whatever, we may yet advance in a knowledge of the real nature of the affection if we succeed in establishing its pathology in relation to normal function. My contention has

[1] *On Migraine*, &c., p. 392.

been that this relationship is clear and distinct; that the natural history of chorea is in harmony with—nay, that it blends with—our everyday experience of ourselves and of our wives and children; that its symptoms are explained and anticipated by reference to this experience, and are perhaps as well expressed in the terms of common life as in those suggested by a partial likeness between the nervous system and an electrical machine.

I need not allude further to the theories of chorea, so ably advocated by Dr. Hughlings-Jackson and others, referring its phenomena to cerebral changes due to minute emboli or to thrombosis. The more obvious objections to such views have been often urged. The rejection of one hypothesis does not involve the acceptance of another; yet I think both the facts of emotion-display and the facts of chorea itself may fairly demand of those who dissent from the theory for which I am contending an answer to these two questions, which are correlative:—First, why do the phenomena of chorea happen as they do, in order and method and choice of subjects, except it be for some such reason as is here alleged? The theories which

suppose some local change in a nerve-centre as the origin of chorea, even if they obtained the verification of direct observation, which they notoriously want, would still fail to explain the facts. Secondly, if chorea be not the expression by muscular disorder of a disturbance primarily mental, how else is such disturbance signified? That the muscular system responds to such impression always, yet least readily in old age, is certain. Mature life at its period of greatest stability easily acquires habits which withdraw certain muscles from the control of the will in 'nervous twitchings,' peculiarities of gait, and facial grimace—disorders which, if they happened earlier, would not escape either the nosologist's classification or the physician's treatment.[1] Ado-

[1] Muscular distortion or mismovement is so common and so often continued till quite the end of life, that it seems strange, in the great rarity of fatal chorea, that morbid histologists should not have sought in the nervous centres of persons thus affected for post-mortem evidence of so marked and chronic a disease. If slight chorea in a child, at no time severe and unattended by paralysis or other lesion, is yet productive of such marked nervous changes as have been described (as, for example, in cases 1, 5, 6 out of 7 fatal cases of Dr. Dickinson, *loc. cit.*), how much more should changes be found in people who through long lives have had a particular group of muscles in almost ceaseless action, nodding, or twitching, or shrugging! Here one would suppose not only that the morbid con-

lescence has its modes of overflow in all the varieties of mental emotion and muscular spasm which we call hysteria. What is to be given to childhood? Is this period of life alone, where the muscular control is so obviously inefficient and precarious, to know of no motor perturbation sufficiently marked or continuous to obtain notice and name? Or, to put it otherwise, Do the purposeless muscular movements which always accompany emotion, and the emotion of children most, never so far exceed as to assume the proportions of disease; or, if they do, what is the disease like?

In conclusion, I have but a few words to add in reference to treatment. These arise inevitably out of the views just expressed, but rest as well upon experience and generally admitted facts.

1. The duration of chorea is not to be measured by its violence. Whether severe or slight, it is never very short, and—except for the rare accident of counter-shock or the intervention of acute illness—never ends abruptly. Duration and severity being thus independent, it is very difficult to adduce

dition would be more obvious, but that it should be more easy to localise than chorea appears to be.

satisfactory evidence that the course of the affection is favourably influenced by drugs. So far as appears to my own observation, cases treated without medicine yield as good results as those treated with whatever medicine.

2. No treatment of chorea, whether medicinal or otherwise, can be fairly judged of unless by reference to the existing phase of the disease. Chorea has its ebb and flow. Remedies given during its natural decline are apt to be regarded as beneficial, while those taken during its natural rise are regarded as harmful; neither conclusion being, in fact, justifiable.

3. As chorea is a mental affection, its cure is to be sought through a mental appeal. The measures likely to be immediately harmful or useful are, indeed, indicated by the symptoms. Chorea is aggravated by emotion and close inspection; it ameliorates with mental and bodily repose and preoccupation; it ceases altogether in sleep and during intervals of musing. Here, then, are the materials for its cure. Any method of treatment which places the child under obvious surveillance, and thus makes it attentive to itself, must tend to

aggravate the complaint and aid in its development. There is this grave objection to all formal attempts at muscular discipline, to systematic giving of medicine, and the regular visits of a doctor. It is one great aim to draw the child from itself, and to cultivate that frame of mind which at all ages alike is most friendly to bodily stillness—to steady the limbs by steadying the mind. At the same time, we have to regard the disorder as tending each day to become more fixed. It is most necessary to keep in memory the old habits of order which the new have in a measure displaced. To accomplish at once with any completeness the two desired ends of drilling the muscles and diverting the mind, is impossible. Gymnastics, games for the fingers, extension motions, &c., are all apt to fail, because the good to the muscles is more than counterbalanced by the harm to the mind. The best working rule is that which aims to divert the mind in the first place, and re-educate the muscles in the second. Chorea at the starting must have its way. From its first discovery its extension from limb to limb may be regarded as probable, and accepted with good grace without apparent notice. To rest

the overworked and tired limbs; to secure a large measure of sleep; to make the time pass evenly, yet without the weariness of monotony; to save the voluntary muscles the mortification of failure by anticipating the child's wants;—these, as I believe, are the most serviceable duties which can be rendered at the outset of chorea. Yet they must be done without ostentation and without the child perceiving that he is being tended and watched and treated as one sick.

Active measures must come later. When the first signal of improvement is recognised, simple limb-movements may be devised, so that the patient may gather confidence from the observation of his own improvement. It will be less difficult now to disguise the intention of such exercise by making a game of it. Failure is never to be noticed and success always praised, the love of applause being a hardly less powerful motive with the child than with the man. At the same time the petulance and irritability which chorea is apt to gender need precisely the same correction as heretofore. Any special leniency towards such faults, on the ground that the child is ill; anything that would tend, as

it is said, to 'spoil' the child, must tend also to weaken that self-control which it is our main object to strengthen. In this respect all that has been said of the moral treatment of hysteria is equally applicable to chorea.

4. Much has been written of the importance of improving general nutrition—an injunction which, in the case of children, is thought to be fulfilled by means of cod-liver oil and steel wine, with an ample supply of nitrogenous food. In regard to such treatment, I think it may be said that neither iron nor cod-liver oil is of better or other use to children that are choreic than to others. The patients likely to benefit by these agents are recognised by signs with which we are all familiar. Chorea in itself affords no indication for the use of such remedies. So also with nutrition. It is true that a large number of choreic children, as of hysterical girls, show by their furred tongues and disordered excretions that digestion is disturbed, and that they need careful dieting, and sometimes medicinal treatment, on that account. But I do not find that choreic children, as such, require more food, or other food, than their companions. 'Improved nutrition'

is not accomplished, as some seem to believe, by excessive feeding. In the great majority of instances, indeed, the capacity of digestion is precisely satisfied by the amount of food actually taken. You do not nourish *pari passu* with the bulk you get swallowed. The powers of assimilation are much less variable than our popular theories would imply, and even children cannot eat to order. By high feeding (especially with excess of nitrogenous food) nutrition is not improved, but impaired. With the children of the poor, no doubt, and sometimes with the children of the rich, where some theory has prevailed to keep them hungry, more food may be usefully given. The appetite, after all, is the great and imperative regulator.

5. As regards drugs in chorea, I repeat that I have not seen patients improve under their use in such way as would justify the belief that the good (which it is to be remembered is pretty sure to *come* in its time) was due to the means. The gradual improvement of a chorea that has lasted some while (and how seldom is chorea recognised at the first as coming within the province of the doctor) is no proof whatever of any virtue in the medicine

that is being taken. It is the natural course of the complaint. I have a belief, sufficiently strong to induce me to make trial of it on occasion, that arsenic sometimes changes the current of the disease and hastens the time of improvement; yet even this measure of success has been so partial and equivocal that the statement of Dr. Begbie, that 'he has never known arsenic fail in an experience of thirty years,' strikes me as amazing. The asserted efficacy of such medicines as arsenic and antimony in what are called 'high doses,' must be taken in conjunction with the fact (of which examples are numerous in this hospital) that it is the habit of chorea to retreat before general illness. Drugs such as these given in disturbing doses may stop chorea in virtue of their poisonous properties. Some such explanation seems almost necessary to account for the discrepancy between those who never knew arsenic to fail, and those with whom it fails habitually.

Of sulphate of zinc I have made repeated trial, increasing the dose sometimes to as much as half a drachm three times a day, with no result that I could perceive of any kind. Children soon get to receive this nauseous dose with perfect toler-

ance and indifference. The same may be said of the juice of conium.

Of the just now popular method of 'feeding nerve-tissue' by means of oil and phosphorus I have made no trial. It seems more certain, indeed, that phosphorus is a mischievous poison than that it is an available nerve-food. And if it be an available nerve-food, I know of no evidence that the nervous structure of choreic children is deficient in this respect.

There is another drug, which is also a poison, commended on the high authority of my friend and colleague Dr. Radcliffe. It is alcohol. For this child's disease, for 'various reasons theoretical and practical,' Dr. Radcliffe advises the free use of alcoholic drinks, 'pushing them,' as he explains in severe cases, 'until they produce drowsiness.' For my own part both theory and practice seem opposed to such treatment. The effect of alcohol upon co-ordination and strength of will would not predispose me in its favour; while, speaking practically, instances of chorea threatening life and suddenly arrested are not sufficiently numerous to establish a claim in that respect for *any* drug upon

empirical grounds. I can conceive of no reason for giving alcohol half so strong as the very obvious ones for not giving it, nor of any doctrine more dangerous to the poor than that their children's limbs are to be made steady by drink.

6. But while the nature of chorea, no less than the result of experience, forbids us to expect direct aid from the use of drugs, it is idle to place reliance in mere conduct-rules and mental discipline in that severe and sometimes fatal form of the disorder which chiefly calls for medical interference. This extreme condition is happily rare. Succeeding as it does the common and more moderate chorea with which we are all familiar, it may indicate, as I have said, the commencement of irremediable organic changes due to the functional disorder. And, if this be so, the same motor disturbance may by its continuance extend the mischief it has once provoked. In such extremity it becomes desirable to still the limbs by force. It is matter of experience that the movements of choreic children may sometimes be forcibly restrained without suffering. I should not hesitate to employ such restraint in the violent cases in such measure and manner as

the sensations of the patient should seem to dictate. I must add, however, that I have not made such trial of this plan as to justify my commending it on other than hypothetical grounds. For the rest, although the conclusion will seem lame and impotent to those who 'love remedies,' and are consequently slow to distrust them and disconsolate in their absence, I would repeat with the fullest concurrence the concluding sentence of a paper upon this subject by Drs. Gray and Tuckwell, to which, had time permitted, I should have referred at length:[1]—

'An isolated ward, a good nurse, a large crib well padded round, plenty of nutritious food without stimulants,—on these we shall feel inclined to rely in the treatment of severe chorea, till we obtain more conclusive evidence than has yet been adduced that the disease can in the slightest degree be favourably influenced by any drug as yet discovered.'

[1] *On the Expectant Treatment of Chorea.* (*Lancet*, November 18, 1876.)

WHOOPING-COUGH.

THE FACTORS OF WHOOPING-COUGH—THEIR APPARENT INCOMPATIBILITY—ANALYSIS OF PHENOMENA—THE NERVOUS ELEMENT—THE CONTAGIOUS ELEMENT—GENERAL CONCLUSIONS—TREATMENT.

THE occurrence of a case of whooping-cough in Burdett ward reminds me to lay before you to-day some of the points of interest and difficulty in the pathology of this affection. The secret of whooping-cough must yield to clinical inquiry. Its special features and attributes are to be seen and studied in its living incidents; death leaves no discernible trace of them. Yet, common as the disease is, opportunity seldom occurs, in the course of hospital practice, of observing it adequately. The mere inspection of children in the intervals of their paroxysms, as in the out-patient room, is of little service. To study whooping-cough you must live

with it. Thus it happens that experienced mothers come to know more about the disease than some practitioners, and, as a consequence, this most prevalent and least understood of infantile maladies, rarely met with in our wards, and as yet beyond the scrutiny of the pathologist, is regarded as belonging to the province of the nursery, and in the routine of clinical teaching is almost neglected.

The literature of the subject reflects these sentiments. Whooping-cough is very easily dismissed by medical writers. In the necessary absence of post-mortem illustration, there is a singular want of material on which to found or to test conclusions. Much of what has been published has reference to particular specifics, and the multitude of these alleged cures for the disease—infallible to-day, and forgotten to-morrow—is no less remarkable than the contrariety of opinion as to its actual nature.

What first strikes attention in reviewing the phenomena of whooping-cough is the apparent incompatibility of its several factors. It claims alliance with nervous affections, with zymotic diseases, and with ordinary catarrh. If we say that

it is a nervous disease, whence then, has it the property of affecting others, or of protecting the present sufferer for the future? If we class it with the exanthemata, the frequent absence of fever, indefinite duration, and mode of origin make it quite anomalous in that relation. If we insist that it is but an incident of child's bronchitis—a cough whose special character is due to peculiarities in the innervation and mode of breathing of early life—how, then, should convulsive cough become contagious, or a single attack of such cough provide future immunity?

If you consult books, you will find whooping-cough, like most other affections, divided into three stages, corresponding respectively with its approach, its presence, and its departure. There is thus the stage of incubation or latency, the stage of the fully-developed disease, and the stage of gradual decline. Yet the idea of uniformity which such a division suggests is not borne out by the reality Whooping-cough is, in fact, stubborn to definition. It would be truer to say that it breaks in anyhow upon ordinary catarrh, that it accompanies such catarrh on and off for an indefinite time, and that

its final departure, although usually gradual, is sometimes quite sudden and abrupt.

It is true, indeed, that the catarrh which precedes whooping-cough is often marked by a degree of pyrexia out of proportion to the apparent lung-derangement, and that on this account, as well as from the early character of the cough, the approach of the disease may be often predicted. But it is true also both that such prediction is not always verified, and that the materials for forming it are not always present. The catarrh which precedes whooping-cough cannot fairly be represented as having anything special or constant about it. There may be little or no catarrh throughout; or catarrh and whoop may begin almost together; or catarrh may be lengthened out indefinitely for a month or more before the character of the cough excites notice. Moreover, it is by no means rare for whooping-cough to stop all at once in mid-career upon change of air, and it is quite common for it to stop thus for a while and then return.

Now, the tendency of cough to become paroxysmal in the course of chronic bronchial catarrh

is part of the natural history of that affection. However it may be explained, it is an almost invariable phenomenon. Even where the catarrh does not increase in area, and where, from physical examination at the time and complete recovery afterwards, it is made certain that the lung itself is not structurally damaged, the character of the disorder in this respect will alter with its age. Prolonged suffocative fits of coughing ending sometimes, as in whooping-cough, with retching efforts, will thus be met with in anticipation of emphysema, and are, indeed, the cause as well as the consequence of that disease.

That in the course of bronchial catarrh young children especially should come to cough paroxysmally is not, therefore, of itself wonderful. Their circumstances seem to lend themselves to such an occurrence. With the known characters of childish respiration, its diaphragmatic mechanism, weak inspiratory force, and the special liability of childhood both to pulmonary collapse and to muscular spasm, —peculiarities which remain so long as a marked tendency to whooping-cough remains,—the more

striking features of the disease (its spasm during life, and the condition of lungs found after death[1]) would seem to be accountable, and such as we might expect. Yet how should the convulsive spasm or the collapsed lung be either the source or the consequence of contagion?

In this obscurity we shall best find our way by following with confidence a single clue, satisfied that nature is not inconsistent. The several phenomena which are here combined have, we may be sure, some real and necessary connection which, rightly observed, will not contradict but illustrate pathological laws. To reach that point of view it is necessary to consider in turn the nature of whooping-cough spasm, the actual mode of its conveyance from person to person, and the bearing in mind of the fact that as a rule the affection occurs but once to the same individual.

What happens in the whooping-cough fit we know. By a rapid succession of violent expiratory efforts with no intervening inspiration, the child's

[1] The lung-collapse found in children dying directly of whooping-cough, was fully described by Sir James Alderson in the *Medico-Chirurgical Transactions* as long ago as 1830.

lungs are partially emptied of air. To this occurrence there succeeds a sudden involuntary inspiratory effort, which yet, owing to a simultaneous spasm of the glottis, only partially refills the chest, giving rise at the same time to that crowing whoop from which the disease is recognised and named. Such a paroxysm may be longer or shorter, single or repeated, followed or not by general convulsion; but it has certain features which are constant. First. So long as the cough lasts, air is continually driven out, none enters; auscultation detects no inspiratory act whatever; percussion discovers a perceptible diminution of chest resonance as the cough proceeds. Secondly. The involuntary inspiration is not free or unopposed; it is met by a partial spasmodic closure of the glottis. So soon, indeed, as the larynx ceases so to act, this, the main feature of the disease, disappears. The *whooping*-cough, and, as some think, the danger of contagion, are no more. And, without trenching upon hypothesis, we may go a step further. By this whooping-cough spasm, the rapid rhythmical movements of the diaphragm, by means of which the child breathes, are suddenly suspended; we have in their

place a violent and continuous expulsion of air from the chest, whereby the space occupied by the lungs is considerably diminished. With the continuance of the cough-paroxysm these organs come to occupy less and less room, while, in proportion to their decreasing bulk, the relaxed and for the time paralysed diaphragm mounts higher and higher within the chest. Picturing the child's condition at the end of such a paroxysm, we are to conceive the contracted and almost emptied lungs with a diaphragm relaxed to its utmost extent, and whose proper function is for the time suspended. We are to conceive this in a subject whose ribs aid little or nothing in the work of respiration, whose inspiratory power is at the best but feeble, while its nervous irritability is extreme. What happens next? By a sudden involuntary inspiration the air is drawn 'with much force and velocity' through the half-closed chink of the glottis. The breath that is wanted comes with spasmodic force; but there is opposed to it this other spasm on the part of the larynx, so that, after all, the air is admitted but sparingly. Observe that this is not a deep inspiration merely, like the soft prolonged sigh of

one who needs an extra supply of air—nay, it is not a deep inspiration at all: it is a shallow one. The blind violence of the inspiratory effort is rendered abortive by means of the laryngeal spasm. The air that enters, as auscultation witnesses, does not penetrate far.

We shall be best able to account for a spasm like this, and interpret the perverted mechanism of respiration, by watching still further the action of the diaphragm. With the extreme relaxation of this muscle, and the temporary abeyance of its function, I conceive it probable that the very first in the train of events which finds expression in the whoop is its spasmodic contraction and descent. Without appealing, for the present, to the medulla oblongata or any reflex mode of stimulation, it seems reasonable to suppose that, in the circumstances of the young child, a sudden suspension of the rhythmical action of its great breathing muscle, and not suspension merely, but such active interference with its function as is implied by its being, so to speak, sucked up into the chest, would suffice of itself (sooner or later, according to the nervous stability of the child) to

give rise to spasmodic contraction. In other words, so soon as the diaphragm, from the abnormal condition of relaxation in which it finds itself at the end of the convulsive cough, first resumes, or attempts to resume, its orderly method of work, I should expect that its first contractile effort should be of the nature of spasm; that the sudden descent should, as in an instant, make room for the full expansion of the pumped-out lung; and that the violence of this revolution should be met by a conservative spasm on the part of the glottis—a spasm which, in fact, controls and regulates that of the diaphragm.

Whether such an hypothesis is to be accepted or not must depend, of course, upon its harmony with other observed phenomena of disturbed respiration under like circumstances. Now there is nothing precisely *like* whooping-cough, but there are diseased states intimately allied with it. There is spasmodic asthma, for instance, implicating the same organs, due to the same or a similar nervous irritability, and often, in later life, taking the place of whooping-cough. The relation of these two—of the asthmatic fit and the whooping-cough fit—

is seen chiefly by contrast. Asthma fit is a condition of extreme inspiration, whooping-cough fit of extreme expiration. The one has not the breath to cough or blow out a candle; the other is a succession of coughs. The asthma fit yields with a sudden expiratory jerk quite peculiar to the disease; the whooping-cough fit yields with a sudden inspiratory spasm which is equally peculiar. I am speaking now of the mechanism of these two paroxysms. They have, indeed, as we shall see presently, a deeper connection, witnessed to in many ways, as in the frequent origin of the one disease out of the other, and the fact that similar causes will excite and similar expedients will cure both. But for mere mechanism we may appeal, not only to pure asthma, but also to general emphysema. How striking is the almost invariable intrusion of genuine asthmatic spasm into the history of vesicular emphysema! Whence comes it that the 'asthmatic element' so uniformly becomes superadded to chronic bronchitis so soon as the lungs have undergone emphysematous change? Why should this condition entail, not dyspnœa merely, but jerking respiration and asthmatic fits?

May it not be that the common features in these three affections—asthma, emphysema, whooping-cough—are due to a common factor: to a perverted or impaired action, that is, on the part of the diaphragm, purely reflex in the case of unmixed asthma; mainly mechanical in the case of emphysema and whooping-cough, being due in the one to the interference of voluminous inelastic lung, in the other to the lung-shrinking and expiratory stasis?

You will say, perhaps, that however the action of the diaphragm may account for the spasm of whooping-cough, this point is really of secondary importance, since it is not the whoop, but the paroxysmal cough, which betrays the disease. Children may whoop or not, according to the violence and duration of their cough.[1] The whoop is an accident to be heard on and off. What we

[1] It is not to be supposed, nor would my theory imply, that the violence of the whoop and of laryngeal spasm is in proportion to the length of the cough paroxysm. It would be so, other things being equal; but other things are not equal. Especially does the nervous stability vary between one child and another. In one catarrh will be the chief feature, the whoop only occurring occasionally when cough is unusually prolonged. In another and probably younger child, with little or no catarrh, the liability to spasm will be extreme, so that a very slight disturbance of the diaphragmatic rhythm will suffice to arouse it.

seek is the origin of the paroxysmal cough, and the reason why, so soon as a child gets it (or, according to some, for an indefinite period before and after), it becomes a source of infection.

Now I pass over for the moment the undoubted fact that, according to tradition and popular as well as medical belief, the whoop itself is very intimately connected with the contagion of the disease, and that no doctor or mother will say for certain that a child has whooping-cough unless and until it both coughs and whoops; and I would inquire what can be made out in respect of the origin and endowments of this affection upon the credit of its nervous relations. Supposing this a nervous disease, what is there about the disorders of that class—all of them sufficiently mysterious—of which we may legitimately avail ourselves to explain, or rather to gather together and formulate, the apparent anomalies of whooping-cough?

It *is* a nervous disease. Witness to that the recurring nocturnal dyspnœa which often ushers in the affection and is lost in it; the strictly periodic character, in many instances, of its paroxysms;[1]

[1] The hooping-cough, however different in its nature and

the influence of habit; the control exercised by the mind, so that by admonition, and still more by threats, the coughing fits can be held in some check. There is besides the remarkable fact—true only of nervous diseases—that whooping-cough, like asthma, and less notably like chorea, is sometimes suddenly arrested by change of place. Moreover, whooping-cough gives origin to other diseases unquestionably nervous; it gives origin especially to the purest spasmodic asthma where there is neither emphysema nor any other organic lesion to explain the sequence. We may be content indeed, and in accord with general opinion, in saying that the earliest *motive* of whooping-cough, as of asthma, is to be found in a 'morbid exaltation of sensibility.' With the instability of the nervous system in early childhood, coughing paroxysm (like asthmatic paroxysm) is immediately excited by *some irritation or other* of the pulmonary mucous mem-

causes from epilepsy, furnishes a curious example of intermittent spasmodic actions tending to like intervals, and these often of considerable length. When no casual irritation is present to provoke the fit, and more especially perhaps when the disorder is declining, it is remarkable how regular the times of seizure occasionally become, retaining the periodical character even to the last. (Sir H. Holland, *Medical Notes and Reflections*, p. 342.)

brane. Thus guarded and generalised, the definition of whooping-cough is pretty generally admitted.

But in all this we do but increase our difficulties. We have to regard the disease in its entirety. Mechanical explanations are too narrow to embrace it all. By as much as we make it probable that whooping-cough is apt to be excited by external stimulation, and when excited to exhibit the particular phenomena which we see owing to the pattern of the childish framework, by just so much do we exclude and render unaccountable those other features of the disease which seem to link it with contagious fevers.

There is no character of whooping-cough more fully recognised in the present day (it was not always so) than its property of spreading. There can be little doubt, indeed, that this feature of the complaint is, from the nature of the case, almost certain to be overestimated. Any affection which is both common and prone to affect large numbers at a particular time and place, will be sure to obtain a reputation for infection greater than it deserves. The spontaneous origin of the disease, however

probable in itself, will never be allowed in the presence of a possible source of infection. There is no affection requiring such caution in this respect as whooping-cough, for there is none so common, or so often seen in an epidemic form. So prevalent is it that there are those who believe that it is the common lot of humanity—that in some shape or other no child born of woman can escape it. Our hospital figures, it must be remembered, understate the actual liability, since they include a large number of neglected children of whom nothing is known. Taking 523 children of the poor admitted in succession into the Hospital for Sick Children, I find that out of 246 boys, 105 were *known* to have had whooping-cough; while of the 277 girls, 132 were *known* to have had it. If, then, we admit, as we must, that a larger proportion of these have had the disease than the record shows, it will probably be no overstatement if we say that half of all children born suffer from whooping-cough. Of what other affection can this be said?[1]

[1] In quoting these and some other figures, I have to acknowledge my obligation to the lady superintendent of Cromwell House, who kindly undertook the trouble of tabulation from the hospital records.

But this is not all. Whooping-cough arises out of catarrh. A child with catarrh is so far more prone to the disease than another child. The chances, then, being pretty even for all children whatever of getting whooping-cough or escaping it, the probability in the case of the catarrhal child will be in favour of its developing the disease. And, indeed, if we hold, with some authorities, that the whoop is no necessary part of the disease, but only a sign and measure of its spasmodic severity, it would be impossible, on the evidence of figures, to deny that whooping-cough was the universal inheritance. The statement could not be positively affirmed; but, if a revelation of that kind were made to us, there is nothing in our statistics to make it incredible.

It follows that, however infectious or contagious whooping-cough may actually be, it is certain to appear to be more of both than it really is. No particular instance of the disease will be accepted as spontaneous when by the most diligent search some other instances can be discovered in any sort of connection with it. From the sociable habits of children and the extreme commonness of whooping-

cough amongst them, such instances will seldom be wanting. If none should immediately occur in the associations of the time, we do not hesitate to interrogate the past and even the future.[1] How easy would it be on the same terms to make spring and autumn catarrh contagious, as indeed many persons firmly believe it to be; or phthisis contagious, as is the common doctrine in Italy! From the nature of the case, statements in sup-

[1] Two illustrations are before me now. In the first, two children living apart, but in a district of London where whooping-cough was very prevalent, spent an afternoon together; neither was suspected of whooping-cough, but one had cough. They parted, and some time later this latter developed whooping-cough. After a while (I have not the exact dates) the other had whooping-cough also. There is no doubt whatever in the mind of her mother that she took it of her companion. In the second instance two other children were in close company on a certain day. Neither had whooping-cough, but the one had had it in a different part of the country ten months before. She had not whooped for eight months, but in that interval had suffered (five months before the meeting) from bronchitis. Ten days after the visit the second child began to cough, and within a fortnight to whoop. There is no doubt whatever in the mind of the parent of this child (who in this instance is a well-known physician) that this, too, was an example of contagion. I am not saying that he is wrong—I only say that if the influence of contagion is made to reach back and to stretch forwards without limit, the disorder is so common that we may get at it, with due industry, in every instance. We are not therefore to deny that whooping-cough is contagious. We are justified in denying some of the modes in which it is said to be conveyed, supposing these to be in themselves improbable.

port of every conceivable method of conveyance must be most easily adduced. The mothers of England, with whom sometimes a certain amount of evidence is equivalent to demonstration, could bring a body of facts to show that whooping-cough contagion is carried about through time and space with no assignable limit. There is no need to be disturbed by such narratives.

Accepting, then, the fact that whooping-cough is contagious, both the circumstances of the disease, and, still more, its own individual character, make it difficult to determine either the mode or the extent of its contagiousness. That it should spread by any method at all analogous to that of scarlatina or measles seems quite incredible. Whooping-cough, if we will but look to the nursery and not to the books, has no uniform course and no necessary pyrexia. It lingers on indefinitely, and may have distinct intermissions. In many instances there is no disturbance of health whatever; only this strange convulsion, aroused it may be by some obvious external cause, such as a draught of air or the contact of cold bedclothes. The doctrine of a specific poison, residing no one knows where, and

communicated no one knows how,[1] is not only a pure assumption, but it imports difficulties of its own. How, for instance, upon that hypothesis, are we to account for the fact that a child with catarrh becomes *thereby* liable to whooping-cough? You never get the one prevalent but the other is prevalent also. Dr. Edward Smith has conclusively shown that the two affections rise and fall together.[2] Whooping-cough is in harmony with catarrh, and out of harmony with zymotic diseases.

[1] Although the numerous believers in the material conveyance of whooping-cough are in the habit of expressing themselves very positively on the subject, there is no one among ourselves, so far as I know, who has pointed out the place of residence of its poison, or the mode of its conveyance. It is otherwise in America. A writer in that country upon *Consumption and its Treatment* entertains no doubt that the disease is conveyed in the sputum, owing to 'the fact that children are apt to cough in each other's faces.' 'We positively deny,' he adds, 'any other kind of contagion in whooping-cough.' (Dr. Both *On Consumption*, p. 73.) I do not propose to avail myself of the authority of this writer, yet the investigation of contagion is already so far advanced that it will be soon necessary for those who adopt the material view of whooping-cough to be as explicit as he is, if less confident.

[2] See *Medical and Chirurgical Transactions*, vol. xxxvii. 'The great similarity,' says Dr. Smith, 'between whooping-cough and chest diseases, contrasted with the dissimilarity between the former and zymotic affections, cannot fail to induce us to regard them as most closely allied, *and may almost suffice to induce us to inquire if they are not in their morality the same disease.*'

Is its poison, then, gendered somehow out of catarrh?

You will remind me, no doubt, that in certain epidemics of measles whooping-cough prevails along with it. I conceive that it does so because measles involves catarrh. In any case the difficulty is not lessened by supposing that the *materies morbi* of whooping-cough is, in some unknown manner, attracted by the poison of measles. If whooping-cough is the solitary illustration of such a principle, it is unfortunate that its claims to specific character should, on other grounds, be so equivocal. It is as little conceivable that the reception of the poison of measles should confer a liability to receive the poison of whooping-cough as that whooping-cough itself, if due to a *materies morbi*, should suddenly depart under the influence of change of air.

What we desire to learn is the precise *mode* in which whooping-cough spreads, not as an epidemic, but when imported from a distance by the introduction into a healthy locality of an infected child. The popular belief (by no means to be neglected) would seem to be, as I have said, that its contagion is far-reaching and irresistible. This is so common

an opinion that, although mothers do not underrate the dangers of whooping-cough, isolation is seldom attempted. Medical men who believe most steadfastly in the conveyance of the affection by a material agent are often equally positive in asserting that no precautions, such as its material nature would suggest, are practically efficient to ward it off. Accurate observations on this point on a sufficiently large scale are sorely needed. The experience of the Hospital for Sick Children,[1] such as it is, tends to show that the spreading is not from bed to bed, but from one spot to another. It does not travel in steps in a given direction, but hops about hither and thither; so that within a certain area, *cæteris paribus*, all the individuals included are equally liable to it. The child in the next cot to whooping-cough is not more dangerously situated than the child furthest removed, or even than a child in the neighbouring ward.

It may seem superfluous to dwell on these seeming anomalies of whooping-cough when re-

[1] The new hospital in Great Ormond Street contains a ward specially devoted to whooping-cough. We are thus, for the first time, provided with a means for studying this obscure disease accurately and continuously.

garded as belonging to the group of zymotic diseases, since we have, for the present at least, accepted a definition of these affections which in terms excludes it. The essential characters of zymotic diseases are these: 'They are all febrile; they all run a definite course; they all present, during some portion of their course, certain distinctive spots, spot-markings, or eruptions on the surface of the body.'[1] However convenient it may

[1] The quotation is Sir Thomas Watson's in the *Nineteenth Century* for May 1877, p. 380, where, however, is to be found on the same page, whooping-cough included by name as one of the recognised zymotic diseases.

Two facts in connection with whooping-cough are instructive. One, that no year passes without its contribution of new remedies; the other, that as each of these remedies is announced, accounts are published of its uniform success in a number of instances, until presently some conspicuous failure is recorded, whereupon the particular practice (with such theories and explanations as have grown out of it) immediately disappears. Now there is no room to doubt that sudden recovery from whooping-cough does actually follow the use of these several remedies at these times. For a while the drugs exhibit a virtue in the hands of those whose spirits are stirred in their behalf, which they never retain for long, while the first confidence once lost is hardly ever restored until the lapse of a period which, with the material at hand, might perhaps be approximately calculated. This continually recurring sequence of events concerns nervous affections generally, and is among the higher problems of therapeutics, but it is nowhere so conspicuous as here. And the wonder is, with the present beliefs in regard to whooping-cough as a contagious or conveyed disease, this notion of its sudden cure should be so readily accepted. No instructed person speaks now of curing scarlatina or measles; it is

be to cling to the doctrine of a conveyed poison in whooping-cough, we cannot both do that and, at the same time, preserve the faith acquired with so much labour as to the invariable behaviour of such poison.

Whooping-cough, therefore, seems out of the rule of those diseases which it partially resembles. No single category can compass it. In its nervous relations it is consistent and uniform; but, looking further, it becomes anomalous and surprising in that property of contagion which, to some extent, it seems to share with diseases of a totally different character. We must either accept this position, and make a special place for whooping-cough, or we must adopt some view of its contagion and of its single occurrence which shall be exclusive of any theory of specific poison, and in conformity with its nervous associations.

What can be made out of whooping-cough on this latter hypothesis? May it not be infectious, not like scarlatina or measles, but like fear, or pity,

universally admitted that such an expression would be inappropriate. It would seem to follow that whoever deliberately sets himself to cure whooping-cough ought first to renounce his faith in the zymotic character of the disease.

or discontent? It would, at least, be difficult to say how far contagion in that sense enters into the history of nervous affections, and quite misleading arbitrarily to limit the operation of that principle by calling it 'imitation,' conscious or unconscious. Imitation is an attempt to resemble; 'unconscious attempt' is a confusion of words. Let us consider the phenomena themselves, rather than reduce their significance by inadequate expression. How cough is contagious, so that in a multitude, however absorbed, the coughing of one will impress the rest, no one who goes to church need be told. It is the same with yawning and with laughter. Similarly, nervous diseases are not imitated merely; they are conveyed in a degree which is beyond all power of imitation. The girl in presence of hysteria does not imitate it; she gets it. The child in the same ward with chorea does not 'attempt to resemble' choreic movements; she gets the disease chorea. There are some notable instances where epilepsy has been caught in the same way. 'Catching a habit' is a proverbial expression, and applies in a special manner to early childhood; but the full force of the principle

which it illustrates in its further application to disease is hardly sufficiently admitted.

Some facts of whooping-cough which tend to bring it within the operation of this law have been already incidentally mentioned. The disease spreads, not by contact, or absolute propinquity, but to the children about and within hearing. You cannot isolate it. Mere infants, liable enough to whooping-cough, and with a conformation admirably adapted for its reception, are yet irreceptive of it from others. Thus, the baby of the family will either escape the complaint altogether, or take it late, when by long persistence the impression it makes has forced itself upon its dull perceptions. Meanwhile, the elder children will have the disease strictly in company. The whooping of one will be a signal for the rest, and the whole will cough in chorus.

It would be fanciful and absurd to ascribe the wide dissemination of whooping-cough mainly to the operation of this principle of conveyed nervous impression, but it is neither the one nor the other to suppose that this influence co-operates with others to impart to whooping-cough a seeming

likeness to zymotic diseases. An affection to which all young children are liable under *any* circumstances, and which, like the catarrh so intimately associated with it, is very apt to be epidemic, needs no more than some slight share in this property of nervous contagion to earn the character which has attached to whooping-cough since the days of Cullen. On the other hand, if whooping-cough be quite independent of this form of contagion, it is the only disease of the kind that is so. There is no affection with a voluntary element about it, whether chorea or hysteria, or the act of yawning, that does not spread, more or less, by involuntary repetition. Considering the impressibility of the female sex, and the strong 'imitative' instinct of young children, we should be led to believe that in a nervous disease proper to childhood, and commonest with girls, the influence of nervous contagion should be not absent but conspicuous. I might add that those who would reject this view, preferring that of a specific poison, will yet maintain, with Dr. Babington, that, when this poison is spent, 'mere habit will perpetuate what first originated in disease.' If the

whooping-cough spasm can thus be reduced to a habit, it is probable that, like other habits, it may be originally excited in a predisposed person by involuntary imitation (so to call it) of another.[1]

But there is a further difficulty. Whooping-cough, like measles and scarlatina, happens but once. It is here, you may say, dissimilar alike to nervous and to respiratory diseases. Both of these are apt to become chronic, and easily acquire the habit of recurrence. We must observe, however, that there is no intimate likeness between the non-recurrence of certain zymotic diseases and the non-recurrence of whooping-cough. Strictly speaking, whooping-cough is very apt to recur. Every nurse will tell you that this is the great trouble and worry of the complaint. The whoop will appear and disappear. It is no uncommon thing for it to recur after four or five months of silence. So long as bronchial catarrh endures, no interval of freedom will make its return improbable. You are never sure that you have done with

[1] See, upon the subject of nervous contagion, some valuable remarks and illustrations by Dr. Liveing, in his treatise *On Megrim*, p. 384 *et seq.*

it until the lungs are quite free, and the cough is gone. This is not like scarlatina or measles—it is strikingly unlike them. There is no such thing as a repetition of all the distinctive features of these fevers within a very short period from the first attack. The protection conferred is, for the time, absolute. In its habit of receding, advancing, and recurring, whooping-cough is true to the pattern of nervous diseases; it is quite inconsistent with the orderly course and progress of all infectious fevers whatsoever.

But why should children, although they may whoop on and off indefinitely during a single catarrhal attack, have in their lives but a single bout, so to speak, of whooping-cough? Why should whooping with the catarrh of this year secure the patient against whooping with the precisely similar catarrh of next year? Here, too, I believe that the nervous hypothesis is competent to explain the facts, and that whooping-cough does but illustrate the common law in relation to this class of affections. Recurrence is the rule of all nervous disease, but the recurrence is not by way of exact repetition. We do not cease to suffer from the cradle to

the grave, only the manner changes. As the child grows he becomes exposed in turn to all the phases of nervous disorder. There is a fixed time and duration for each—a duration which, inasmuch as it corresponds with certain epochs of life, will be longer or shorter accordingly. Thus the period of dormant infancy is followed by that of dentition, a short and tumultuous time, covering some twenty months, of most active development, and subject to peculiar incidents. To this succeeds an interval of about ten years of comparative calm, interrupted only by the approach of puberty. Nervous lesions correspond accurately with these transitions: each has its proper turn and duration accordingly. That chorea should recur and whooping-cough not, is not really anomalous. Recurrence is common to both, but the period allotted for the one is longer than for the other. The human subject continues prone to whooping-cough hardly more than two years. 'More than half the cases,' says my distinguished colleague, Dr. West, 'occur before three years.' He continues prone to chorea for five times that period. There is nothing that whooping-cough confers which prevents its return

in the future, only when that future arrives the child has outgrown its proclivity ; it has discharged its obligation in this respect, or rather it has changed the nature of its liabilities. On the other hand, the longer period allotted to chorea (commencing accurately at the time of life when whooping-cough begins to decline, and becoming more intractable as puberty is neared) admits of the exhibition of that quality of recurrence which is one of its marked characteristics.

But observe, further, that this liability or proneness to whooping-cough, which, when the whole race is considered, is comprehended within a very short period, must be still further limited for each individual. When it is said, for instance, that, for all children whatever, a special liability to whooping-cough is compassed between two years old and six, it is implied that the individual liability falls somewhere between these extremes. Varying with the rate of development, one child, or one group of children, will encounter the liability at two, another at three, and so on. Hence the fact of a child getting whooping-cough but once will be due to the fact that this single attack covers, or nearly

covers, the whole period of its special liability in this respect.

Why, then, you will say, does the disease, once introduced, run through the whole family, attacking children at various ages indifferently in the absence of any epidemic or other common cause? I would answer that it is not the common rule of whooping-cough to behave so. It usually spares, not only the elder children, but one or two of the younger ones also, both those that have suffered before and one or two besides. It spares, that is to say (or rather, it is likely to spare), both those with whom the period of special liability is overpast, whether they have discharged the debt or escaped it, and those, too, who have not yet reached it. The fact that a child has had whooping-cough is the best evidence that it has passed its liable time. For the others we may not arbitrarily fix this period. It will vary within due limits with the rate of development, as the period of dentition and the advent of puberty vary.

But I may not pursue the subject further to-day, nor should I have been justified in detaining you so long but for the plea that the

pathology of whooping-cough is admittedly a vexed question. The many practical issues involved in it will easily suggest themselves to your own minds. If, for instance, whooping-cough has at all the relations I would claim for it, not only would certain obvious precautions suffice, in the absence of a common cause, to prevent its spread, but that method of treatment by change of habit and residence and associations, so admirably described by the late Dr. Salter in his work upon Asthma, and epitomised by him in the French phrase 'profoundly modifying the situation,' should be as effectual in whooping-cough as in the disease so intimately allied with it.

The conclusions to be deduced from what has been said would be something as follows:—

1. Whooping-cough is a nervous disease of immature life, due immediately, like nervous asthma, to a morbid exaltation of sensibility of the bronchial mucous membrane. Although possible in a modified form at all ages, it has its period of special liability and full development simultaneously with that time of life when reflex spasm is common and the mechanism of respiration feeble

and diaphragmatic. A child of the proper age with catarrh and cough is thus on the very brink of whooping-cough. A large proportion of such children will develop the disease for themselves upon casual provocation, all contagion and all epidemic influence apart.

2. The whoop of whooping-cough is due to a spasmodic contraction of the diaphragm which follows its extreme relaxation upon the emptying of the lungs by spasmodic cough, the force of the inrush of air being met by a conservative spasm on the part of the glottis.

3. The natural history and relations of whooping-cough—its uneven course, indeterminate duration, method of recovery and cure, frequent absence of pyrexia, seasons of prevalence and connection with epidemic catarrh—are in striking contrast with diseases of the zymotic class. Admitting the fact of its contagion, the great commonness of the disease, and its association with our modern influenza, coupled with the popular belief that its source of infection may be indefinitely remote, are circumstances which must combine to render whooping-

cough more contagious in appearance than it is in fact.

4. In its character as a purely nervous disease whooping-cough may be contagious under favouring circumstances, like other nervous affections of a quasi-voluntary kind. The assumption of a specific morbid poison is both hypothetical and gratuitous, or so nearly gratuitous that the facts it seems to explain are insufficient to counterbalance its inherent improbability.

5. The non-recurrence of whooping-cough is not, in strictness, analogous to the non-recurrence of contagious fevers, nor out of real harmony with the pattern of nervous disease. It is the rule that affections of this class alter their shape with the successive epochs of life, so that each will appear either solitary or recurrent, according as the time allotted for it is shorter or longer. The after-infancy period to which whooping-cough attaches is one of brief duration and special liabilities. The features of the disease are thus in strict correspondence with the characteristics of its time of life.

6. The specific remedies for whooping-cough

(which have their season and may be said now to include all drugs whatever of any potency) have all of them a certain testimony in their favour. They agree in a single point: whether by their nauseousness, the grievous method of their application, or the disturbance they bring to the child's habits and surroundings, the best vaunted remedies—emetics, sponging of the larynx, ill-flavoured inhalation, change of scene, beating with the rod—all are calculated to *impress* the patient, and find their use accordingly.

APPENDIX.

THE STARTING-PLACE OF CHOREA.

INFORMATION is often wanting in reported cases of chorea as to the limbs or muscles first attacked. It is notorious, indeed, that the upper limbs suffer more than the lower, and that a very common mode of extension is from one hand or arm to the other. It is further certain that the limbs which yield earliest and oftenest to chorea are those which are most easily affected in ordinary emotion. Now, assuming the movements of chorea to be due to mental impression, or rather selecting those instances of it which are most certainly of that origin, it is of interest to inquire whether the starting-place of the disorder is at all determined or modified by the particular character of the injurious impression.

On this account, and for others which will appear, the following case is quoted :—

Rebecca N., æt. five, the youngest and weakest of five children, was admitted into the Westminster Hospital, May 5, 1877. She is very intelligent and sensitive. A

year ago she had whooping-cough badly, the other children escaping. Two weeks ago she complained of headache, and objected to go to school; on the way thither she suddenly screamed, in the mother's words, 'as though a dog had bit her, although no dog was there.' On the following day it was observed that she moved the right hand restlessly. The mother attributes the attack to 'too much study.' The child has not been frightened nor has she complained of pain, except on the occasion just referred to.

The patient is somewhat anæmic, fairly nourished, with very mobile features and emotional temperament. The tongue is protruded steadily; there is no sign of ill-health. When placed in bed, however, the child's right hand and forearm and, to a less extent, the right foot are found to be restless, the disorder being strictly confined to these parts; the face-movements, also considerable, are yet not in excess of those often observed in sensitive and self-conscious individuals. The choreic movements are to some extent under control and are most so when under observation; but by no effort of will, although this is evidently exerted, can the child keep the right hand still. In her attempts to do so she will rest it upon some support, or clench the fist, or let the hand droop from the wrist, and in these positions it is nearest to stillness. Extended and without support it is the most restless. The movements of the foot, and in a measure of the whole leg, though obvious enough, are much less marked than of the upper limb. The child at first had imperfect

command of this right leg, and was apt to fall; soon, however, she could run about with no noticeable defect in gait. There was no chorea whatever of the other limbs.

At first it was noticed that the heart-sounds were natural, but subsequently, during the time of listening, a distinct regurgitant mitral bruit became audible, which continued for a few beats and then disappeared. This condition of things recurred on many occasions, and was verified by several observers, though the murmur was more often absent than present. It was the more striking because, unlike the soft and so-called 'hæmic' or 'anæmic' bruit common in chorea, this blowing sound made its presence at once obvious, and would suddenly break in upon the ear whilst listening to what seemed a quite normal first sound, and then as suddenly disappear. It was thought that muscular exercise tended to develop the morbid sound, but of this I was by no means certain.

This case possesses interest on the following grounds:—

1. The affection began in the right arm and hand, whence it extended to the leg and foot of the same side.

2. Mitral regurgitation was an occasional phenomenon, the heart's action as a rule being normal.

3. In its full development the disorder was confined to the right side, the arm and hand suffering most and longest.

I. When *pain* is the immediate precursor of chorea the painful limb is often the first to become unsteady.

When also a particular set of muscles are fatigued, these are apt to suffer more than the rest. Upon the same principle it is possible that chorea may be right or left, according as the limbs of one side or the other are the more tried. In a case like the present, for instance, due, as the mother believes, to 'over-study' (study in this particular instance meaning the training of the right hand to write and do needlework), the unequal exercise of the hands may be the cause of chorea beginning in the right. If this be so, we should have for children of this sort a preponderance of right-handed chorea. But there is certainly no such preponderance on the whole. It is asserted, on the contrary (I know not on what evidence), that left-handed chorea is somewhat the more common. The facts would therefore require that, except for school discipline (which contributes largely to chorea), the left hand should be much more prone to the disorder than the right. This, too, might be accounted for on the supposition that children mentally or emotionally over-taxed, yet so young as not to know right from left, but using both alike, should suffer disorder of that side which by long inheritance was the least subject to control—that is, the left. Left-handed chorea would thus be the rule of commencement; yet special circumstances would often interfere, and especially the overtaxing of the right hand in schooling or any nervous strain which appealed to the one side rather than the other. The offended member would be the first to suffer, whether right or left; or, if there were no special offence to one limb more than

another, the limbs would suffer either all together or in the order of their instability.

Now the various sources of terror, according to their nature, bring into sudden and unexpected exercise various groups of muscles—where the terror is such as to suggest escape the legs are thus tried, not only by their action in flight, but by the sense of fear which stimulates that action to the utmost, and gets mentally associated with it afterwards. In other cases it is the upper limbs that are most engaged, one or both, as where the act of grasping, or shielding, or striking can save the threatened catastrophe; and here, too, there is more than the mere muscular effort—there is the sudden shock which, in an instant, before the arrival of alarm, stimulates certain muscles to an extraordinary exertion. The movements to avoid a blow or recall a step (as in the precipice-walking of some dreamers), or to escape some disgusting contact, are of this kind. They communicate a shock of their own; and so much do they anticipate any conscious volition that they will save from danger which the mind does not realise till afterwards, as though separate territories of the muscular system kept a watch of their own for the common preservation. And not only so, but the muscles thus suddenly called into action will be agitated apart from the rest, both at the time and afterwards. The recollection of the incident will recall the muscular no less than the mental part of it, and often so powerfully as again to produce actual movement. Even when there is no grave disaster but only some pleasurable act to

recall, the face will resume the expression of the moment, the hand will repeat its past performance, the fingers will itch for their former employment, the feet move to the old measure.

If the reader will but recall the common causes of chorea (and I need speak now only of that which is admitted to be of mental origin), or read some tabular enumeration of them, as, for example, that appended to Dr. Dickinson's article upon chorea (*Med.-Chir. Trans.*, vol. lix., pp. 30, 31), he will find a list of terrors calculated to produce particular muscular movements—'frightened by a dog,' 'butted at by a goat,' 'chased by a cow,' 'nearly run over,' &c., &c. My conjecture is that the manner of the chorea in these several instances would be in accordance with its mode of orig.n (other things not interfering); that certain groups of muscles would be mentally impressed more than others, and become choreic in consequence.

I have had charge of some cases lately which help to bear out this view—which have, indeed, suggested it. A boy of eleven was much alarmed by an explosion of gunpowder which slightly scorched his face. He got choreic twitching of the eyelids, which ceased after a course of shower-baths. A boy of six was frightened by a dog suddenly jumping up at him; he got chorea of the hand on the side of the dog's approach. A girl of eight, and another of ten, having accidentally pinched the fingers of one hand, became choreic in those fingers. A girl of eleven, stooping to pick up, as she thought, her brother's cap, found

to her great alarm that she had seized a dead rat. She became choreic in the offended hand (the right), and so violently that, although the general chorea which followed was not severe, the hand that had been used was so affected that by no effort could it be kept still.

A very large number of cases would, of course, be needed to verify the hypothesis which I am now assuming to be thus illustrated. To vindicate the principle, however, it is not necessary that the muscles chiefly assailed should *always* be the first to suffer, or, indeed (failing any such local assault), that the natural order of muscular surrender should *always* be followed. There are many interfering circumstances to modify the law, if law it be. Thus, the presence of danger may fail to excite a suitable muscular movement, and produce instead a general paralysis, and presently a general chorea; or the muscular act that would seem the most appropriate may not be that suggested to the patient; or the chorea which the fright excites may be but the revival of a former attack, and, as such, obedient to its old form. In such circumstances the law is not broken, but modified. When the fullest allowance has been made for such exceptions there will still remain material enough upon which the principle may be tested.

II. A word may be said as to the intermittent character of the heart-murmur in the present case. This is no new observation. For the heart's action to be uneven or irregular, for its bruit to come and go, or be present in one attack and absent in the next, these are common

features in the chorea of childhood. What is unusual is this: that the mitral valve should permit regurgitation for a moment or two, and then revert to its normal action, and that it should be in the habit of faltering in this way. This phenomenon, rendered the more obvious in the present instance by the distinctly blowing character of the murmur, lends support to the view mentioned in the text, that in chorea the earliest defect of the heart is due to muscular disorder, and not to any structural change; 'that,' as Dr. Dickinson expresses it, 'the collection of fibrin is the consequence, and not the cause, of the regurgitation.'

It has been fancifully supposed that unevenness of rhythm, which is often the earliest signal of heart-disturbance in chorea, might be in some measure due to the irregularity (which is sometimes extreme) of respiration and unequal delivery of blood from the lungs. It is enough to say that facts do not support such a doctrine. It so happened that, along with the child in question, whose breathing was little disturbed, there was admitted a boy of nine, in his third attack of severe and general chorea, affecting very markedly the muscles of respiration. He had no irregularity of heart and no murmur.

The liability to heart-implication in chorea is not to be estimated by its severity, or seat, or class of subject. It appears, however, to depend somewhat upon age. As the patients grow towards puberty and chorea becomes rarer—representing, for the most part, the outlasting or revival of the child's disorder—so does the heart-affection

become rarer too, and with adults this liability seems to disappear.

III. However we may account for chorea commencing in a single member and spreading thence to the others, we have yet to account for its remaining sometimes strictly one-sided, as in the present instance. It cannot be supposed that the limbs of one side of the body are naturally less stable than those of the other, nor yet that the whole of one side should be subjected to the kind of strain I have been speaking of as applicable to particular limbs. Both the principle of successive surrender of muscles, and the principle of some localised offence (so to call them) fail us, therefore, when we come to consider what has been called *hemi-chorea*. And we are in this dilemma, that while some explanation is required for such cases, none will serve which does not both account for the fact and account also for its being exceptional.

In the present instance, although the disordered movement was confined (so far as the limbs were concerned) to one side of the body, the chorea in other respects was not anomalous. It spread from limb to limb as usual. The hand and arm suffered first, and afterwards the foot and leg. It is very rare, I believe, for hemi-chorea to happen in any other way than this. The comparison with hemiplegia, which the term suggests, is apt, therefore, to mislead. There is no such thing as a 'stroke' of chorea where the whole of one side is stricken at once, the face as well as the limbs. It never happens in one-sided chorea, so far as I know, that

the face-muscles are choreic on one side only. It may be added that rheumatism and valvular disease are not more common with this than with other forms of chorea. What has to be explained, therefore, is not the sudden seizure of one side of the body, for no such thing happens; it is the fact that chorea, spreading as usual from limb to limb, is yet confined to the muscles of one side.

Now, inasmuch as chorea is often partial, why, it may be asked, should it not happen sometimes that the limbs chosen belong to the same side of the body? The reason has been given. The arms and hands yield naturally to chorea with much greater readiness than the feet and legs; so that unless both arm and leg of one side have been subjected to overstrain—an event which can seldom happen, and which, in most instances of the kind, is known not to have happened—one-sided chorea is an anomaly.

May it not be in these exceptional cases that the leg suffers in sympathy with the arm because the brain lesion which the arms' over-exercise has induced implicates a region whence both arm and leg derive their motor functions? In such a case as the present, for instance, the leg becomes choreic (later than the arm, and for a shorter time), not because it has shared in the overstrain of the arm—for this is clearly not so—but because both arm and leg depend for their motility upon the integrity of a common centre. Some exceptional irritability on the part of this latter permits the disorder of the upper limb

to be reflected forthwith to the lower. The rule by which chorea spreads from side to side in obedience to the same law which makes the several muscles responsive to ordinary emotion in a certain order is thus interrupted, and the disorder spreads, not from one arm to the other as usual, but from the arm first affected directly to the nervous centre, whence it is next communicated to the leg of the same side.

Such a supposition corresponds at least with the actual order of events. Whether it or any similar hypothesis can be maintained must depend, of course, upon the analysis of many cases where the mode of commencement and order of progress of the muscular disorder have been carefully observed. Unfortunately, examples of one-sided chorea are quoted for the most part in support of an antecedent conclusion, and are not always related in such detail as to be of service for this purpose. With the comparative rarity of the event, therefore, the material at hand is far too scanty at present for any conclusion.

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